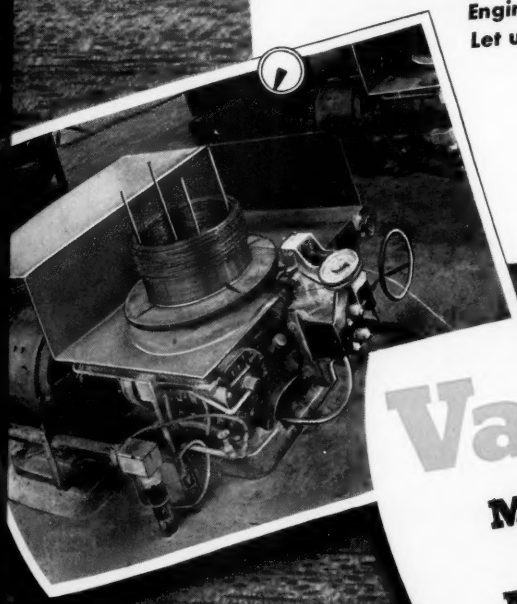
WIRE AND WIRE PRODUCTS

NOVEMBER, 1946

ENGINEERING DOES IT!

Beyond the factors of precision manufacture and fine materials in Vaughn Machinery performance is the ultimate quality of *Vaughn Engineering* . . . a continuous, intensive and creative process that is based upon our many years of complete familiarity with the needs of wire producers. *Vaughn Engineering solves wire drawing problems! Let us cooperate with you!*



Vaughn

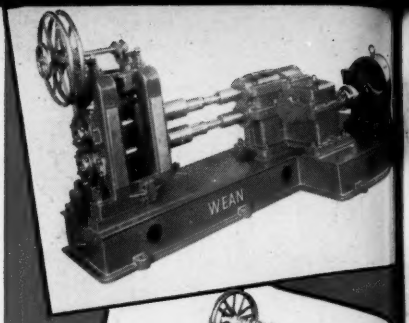
MOTOBLOC and MOTOBLOX

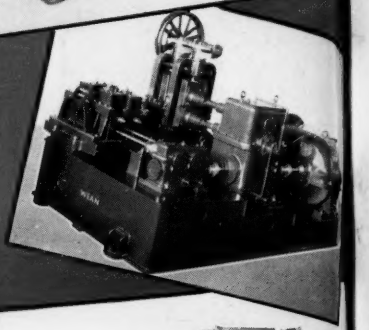
THE VAUGHN MACHINERY COMPANY
CUYAHOGA FALLS, OHIO, U.S.A.

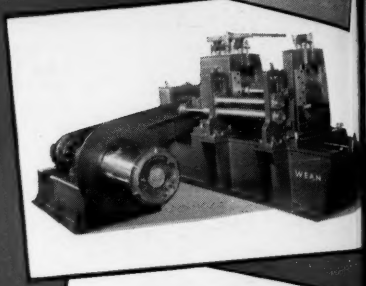
COMPLETE COLD DRAWING EQUIPMENT . . . Continuous or Single Hole . . . for the Largest Bars and Tubes . . . for the Smallest Wire . . . Ferrous, Non-Ferrous Materials or their Alloys.

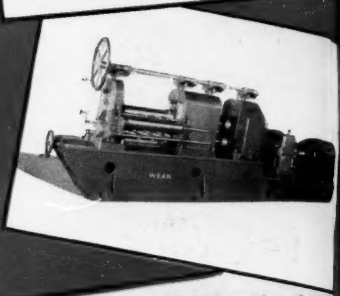
OFFICIAL PUBLICATION OF THE WIRE ASSOCIATION

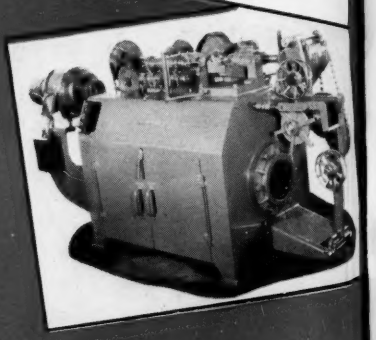
WEAN EQUIPMENT *Corporation*











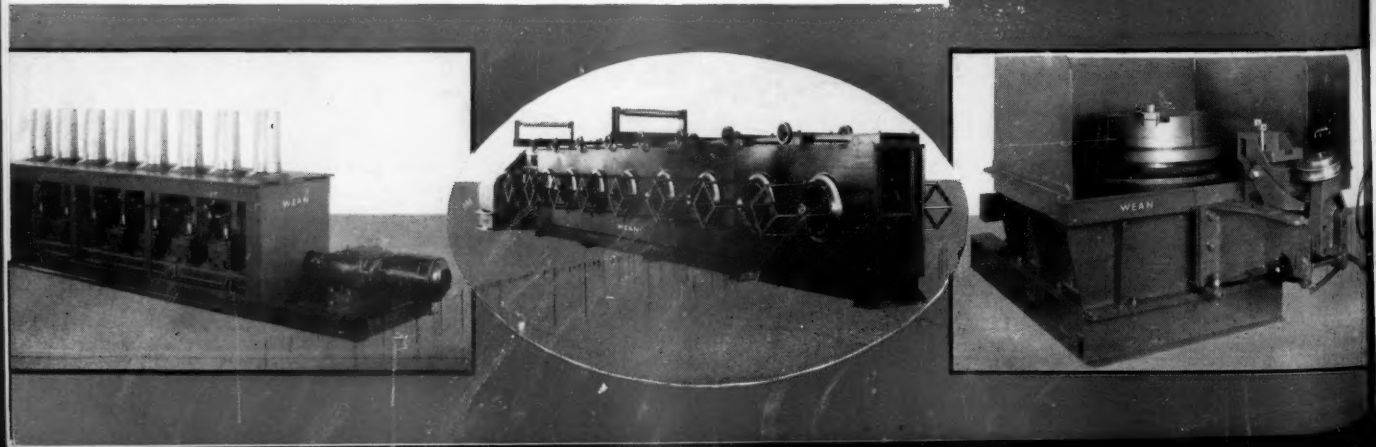
So that the Company may be more readily identified with its ownership and its products, (strip steel and wire mill equipment), the stockholders of The Broden Construction Company have deemed it advisable to change the name of the Company to WEAN EQUIPMENT CORPORATION.

The continued cooperation of our customers, employees and friends is earnestly solicited.

President

The Wean Equipment Corporation's physical properties include the entire completely equipped plant of The Broden Construction Company and in addition all of the buildings, machinery and facilities that were originally furnished by the Reconstruction Finance Corporation to meet Broden's wartime needs. This means that the Wean Equipment Corporation has available for its customers' use over 50,000 square feet of building area well equipped with the most modern machine tools, cranes and assembly area for the production of strip steel and wire mill machinery.

WEAN EQUIPMENT CORPORATION
22800 LAKELAND BLVD. • CLEVELAND, OHIO



LOOK AT THE EXTRAS YOU GET WITH CARBOLOY (TRADEMARK) CEMENTED CARBIDE "COMPLETE PACKAGE" DIE SERVICE!

SERVICE CENTERS AND FIELD ENGINEERS

Here's "double-help" for you: Completely equipped Die Service Centers (in Detroit, Chicago, Pittsburgh & Thomaston)—AND expert field Engineers—both available to help you in servicing or finishing dies.

LOCAL STANDARD STOCKS TO SUPPLY YOU PROMPTLY

A great aid to you in maintaining production schedules! Stocked in Detroit, Los Angeles, Pittsburgh, Chicago and Thomaston, Conn.—assuring speedy delivery in metal-working areas coast-to-coast.

FREE TRAINING OF YOUR PERSONNEL

In Carboloy's Die Training School in Detroit, your die room personnel receive thorough training in carbide die application and maintenance methods. Up-to-the-minute training for newcomers or seasoned veterans!

APPROVED DIE ROOM EQUIPMENT

Die finishing and servicing equipment made or recommended by Carboloy assures you of an efficient die room. Combine well-trained personnel with high-efficiency equipment and it spells fast die finishing in *your* mill.

4 HELPFUL SERVICES BESIDES TOP-QUALITY DIES!

That's getting your money's worth!

FIRST, Dies that are known throughout Industry for amazingly long life, closer tolerances on drawn parts, fewer "rejects", lower cost-per-piece, and fine surface finish.

SECOND, 4 valuable extra services that will boost production, speed output, and increase earnings in your mill. When you need fast servicing or finishing, Carboloy Die Service Centers are available to you. When you need "trouble-shooting" help, our expert Field Engineers are right at hand. If you want to know the best equipment for your particular operations, Carboloy will give you counsel that saves you money. And when you want to train your personnel on latest, most efficient Die Room methods, our highly-regarded Training School is open to you—at not one cent of cost!

All this comes with your Carboloy Cemented Carbide Die Order. Why not take advantage of it?

EXPERT Advice At Your Elbow!

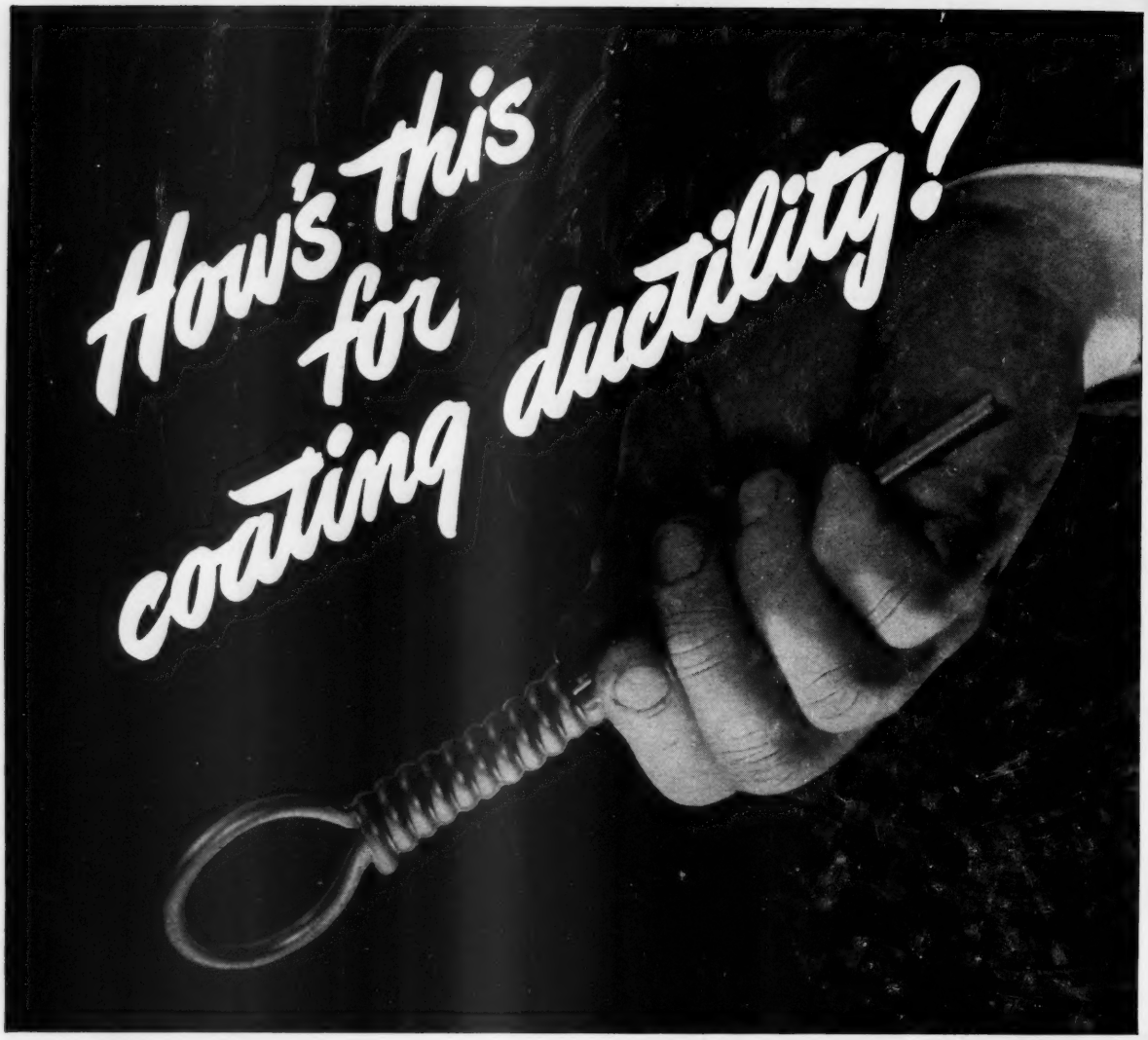
Carboloy's Die Service Manual is one of the most comprehensive die manuals obtainable. Gives *the expert answer* that solves problems quickly. Don't be without it. Send today—

CARBOLOY COMPANY, INC., 11171 E. 8 Mile Road, Detroit 32, Michigan

Chicago • Cleveland • Detroit • Houston • Los Angeles • Milwaukee • Newark • Philadelphia • Pittsburgh • Thomaston, Conn.

Specify CARBOLOY (TRADEMARK) CEMENTED CARBIDE { For "Complete Package" Die Service

Authorized Distributors: Hartley Wire Die Co., Thomaston, Conn. • Michigan Wire Die Co., Detroit, Michigan



It's a severe twist, all right! But for bethanized wire it's easy. Here's why.

Bethanized wire can take all kinds of severe twists and bends without cracking or flaking of the zinc because the bethanized coating is so ductile, and so perfectly bonded to the steel. It is made of zinc that's 99.9 per cent pure—pure all the way through to the steel. The coating is tightly locked to the steel base wire by an advanced electrolytic process, making the zinc and the steel almost one metal.

So tightly does this ductile zinc coating adhere to the steel that bethanized wire can be wrapped around its own diameter as shown above . . . bent back flat upon itself . . . even drawn down to fine gauge . . . all without coating failure.

What's more, bethanized wire is highly resistant to corrosion, thanks again to its superb coating. For the bethanized coating is so pure, so uniform, that it combats rust at every point. Where exceptionally severe corrosion calls for extra protection, bethanized coating-weights can be upped to three times as heavy as those called for in conventional Type 3 galvanizing.

Use bethanized wire next time a difficult fabricating job comes into your shop. Complete details about bethanized are available from the nearest Bethlehem district office. Or write to us at Bethlehem, Pa.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

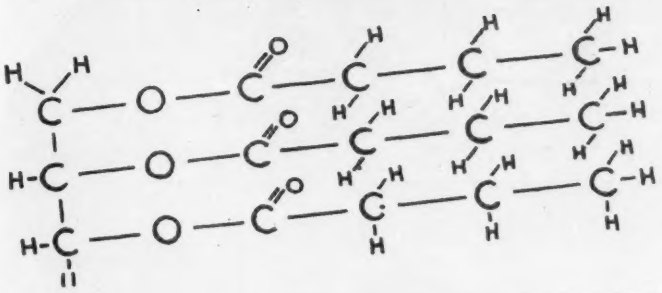
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

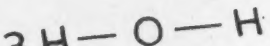
Export distributor: Bethlehem Steel Export Corporation, New York

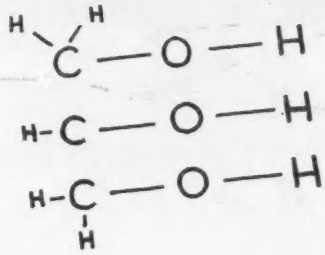
★ Bethanized Wire ★

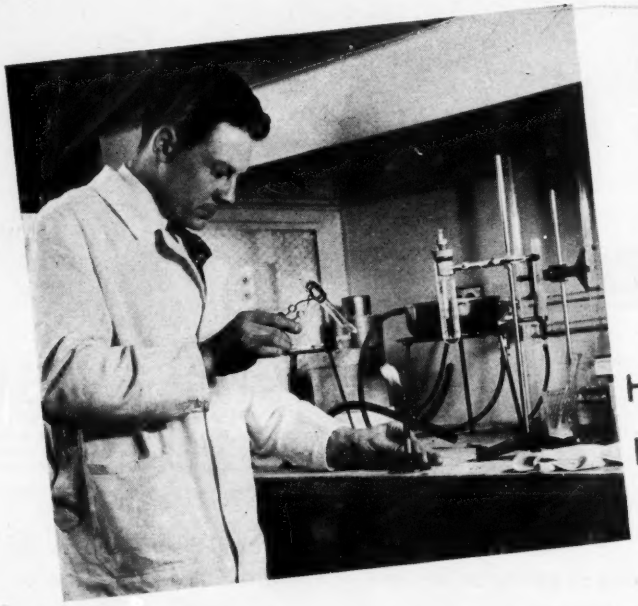
BETHLEHEM STEEL

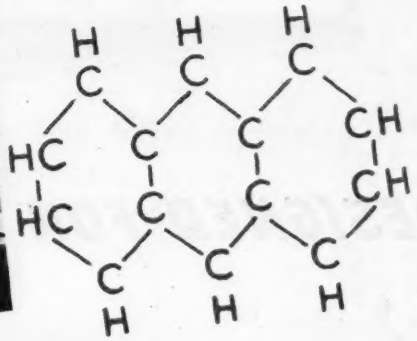
WIRE & WIRE PRODUCTS, Vol. 21, No. 11, November 1946. Publication Office, at Cliff St. New York 7, N. Y. Executive Office, 300 Main St., Stamford, Conn. Published monthly by the Quinn-Brown Publishing Corp., Richard E. Brown President; R. S. Spengel, Sec. and Treas. Subscription price: U. S., $5.00; Canada, $5.00 per year, 50 cents per copy; Foreign, $7.50 per year. Entered as second class matter, June 14, 1946, at the Post Office, New York, N. Y., under Act of March 3 1879.











CHEMISTRY BY SPECIFICATION

THERE is more to Chemistry today than meets the eye. It is no longer a more or less hit or miss, trial by error method of testing now this combination, now that. Improved formulas are explored and achieved based on known structures, weights and movements of molecule and atom, and on skillful mathematical computations.

In the field of wire drawing lubrication lie possibilities for improvement that challenge the highes skill of industrial chemistry. We therefore give it our specialized attention and study, knowing that it is only by close application in this field that we can achieve the improvements you specify as essential to the desired success of your over-all wire-drawing operation.

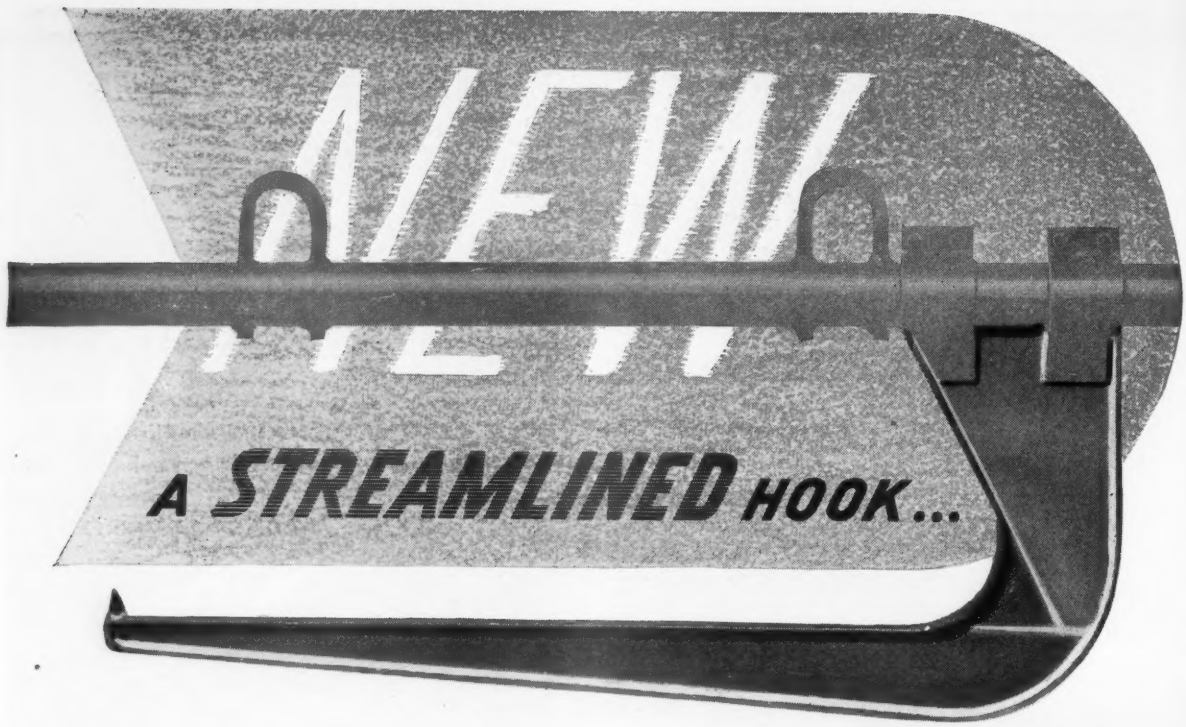
We welcome these "calls by specification" upon our ingenuity and chemical skill. Do not hesitate to make your wire lubrication problems ours to solve as well. . . . Address Technical Department,

STANDARD INDUSTRIAL COMPOUNDS COMPANY

4600 W. Ferdinand Street, Chicago 44, Ill.

Standardize with Standard

Standardize with Standard



HAIRPIN PICKLING HOOK used in prominent steel plant for handling wire coils. Fabricated from standard mill forms of Monel by The Youngstown Welding & Engineering Company, Youngstown, O., this lightweight hook is ideal for heavy-duty service.

DESIGNED FOR LONG LIFE

Now you can have a lightweight pickling hook! One that's as strong as any you've ever used. One that's more corrosion-resistant than many heavier hooks. One that's designed for real economy.

Made of Monel* by **The Youngstown Welding & Engineering Company**, Youngstown, Ohio, the streamlined pickling hook illustrated here handles a 3000-pound load easily . . . and with enduring safety.

Monel resists the corrosive action of hot pickling acids. It has the high strength and toughness required by equipment that is subject to strain and stress. Monel hooks last despite bumps and jolts that fracture less ductile metals.

When balky, old-fashioned equipment stalls production or requires costly maintenance, there's a good chance that Youngstown can suggest an improved, lightweight design in Monel to meet your needs.

Why not write them — or us — for further information about economical, trouble-free pickling equipment? *Reg. U. S. Pat. Off.

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL STREET, NEW YORK 5, N.Y.

MONEL... ONE OF THE INCO NICKEL ALLOYS

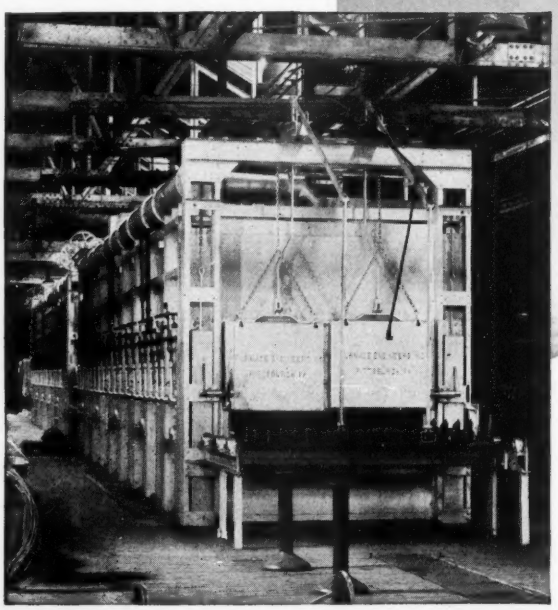
DO YOU WANT *Optimum* RESULTS?

Equipment Produces Quality Controlled Products

Patented Combustion System Increases Production

Burners Reduce Fuel Costs Per Ton

Equipment Engineered For The Wire Industry



Direct fired cover annealing furnaces.

Spheroidizing, normalizing and bright annealing furnaces.

Patenting and galvanizing furnaces.

Lead and salt furnaces for Isothermal, Martempering and Austempering treatments.

Salt bath descaling furnaces for alloy and stainless steels, etc.

F. E. I. patented burners and combustion system can be installed on existing furnaces.

We invite your inquiries on equipment where hardness, physical properties and structure are required to meet present day requirements on a tonnage basis.

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1551 WEST LIBERTY AVENUE ★ PITTSBURGH, PA.

9 WAYS to Improve WIRE DRAWING

FOR more than three years a new coating for wire drawing has been used by many mills instead of lime. The results obtained are outlined in the data submitted below.

MAGNUS METAL COAT #267

on the basis of the results it has obtained, warrants a most careful investigation on your part. Here is what it offers you:

1. **Better Finish** on any wire, particularly on stock drawn for metallic coating and other special finishes, and on bright, rope, welding and tire bead wires.
2. **Reduced Rejects**—rejects caused by scratching and off-size wire are virtually eliminated.
3. **Better Rust-Proofing** than was possible before Magnus #267 was introduced.
4. **Reduced Lubrication Costs** due to fact that #267 calls for lean lubrication. In many cases savings amount to as much as 50%.
5. **No Hydrogen Embrittlement** — which is eliminated right in the coating solution.
6. **Longer Die Life** on any drawing operation, but most striking on continuous, high speed operations.
7. **No Liming or Baking** eliminates the trouble, expense and mess of the liming operation and subsequent baking.
8. **Cleaner Machines and Surroundings** which result from the elimination of liming. Greatly improved working conditions.
9. **Reduced Overall Drawing Costs** as a result of savings in liming and baking costs and the improvements in product and operations. Ultimate cost per ton of wire drawn is much less than when lime is used in spite of the much higher initial cost of Metal Coat #267.

LOOK INTO #267

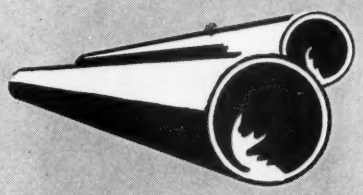
1921-1946 TWENTY-FIVE YEARS OF SERVICE TO INDUSTRY

MAGNUS

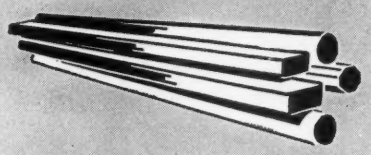
MAGNUS CHEMICAL CO., 188 SOUTH AVE., GARWOOD, N. J.

Wire Drawing Compounds

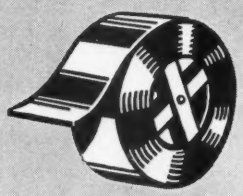
BARGAIN PRICES ON



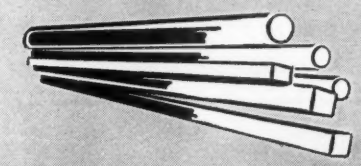
TUBING
Carbon, Alloy and some Stainless. Both Welded and Seamless.



TOOL STEEL
Water-hardening, Oil-hardening and High Speed Grades.



STRIP STEEL
Hot Rolled, Cold Rolled, Carbon, Alloy, and Stainless.



BAR STEEL
Hot Rolled and Cold Finished in Carbon, Alloy, and Stainless.

All steel is subject to priority regulations. VETERANS OF WORLD WAR II are invited to be certified at the War Assets Administration Certifying Office serving their area and then to purchase the material offered herein.

EXPORTERS: The War Assets Administration solicits your inquiries. Communicate with your foreign clients promptly.

NO WAITING FOR

HIGH GRADE *Steel*

Alloy steel billets, blooms, bars, plates, are all immediately available through your War Assets Administration. Bars include rounds, squares, flats and hexagons. Suitable for substitute and re-rolling purposes.

Low prices on this high grade steel make it practical for low-cost products.

For complete information on steel send this coupon to your nearest WAA Regional Office:

TO: WAR ASSETS ADMINISTRATION

Please send me, without obligation, full information on the availability, condition and location of the following checked items:

1. Billets, Blooms, etc. ☐
2. Carbon and Alloy Bars ☐
3. Wire Rope and Aircraft Cable ☐
4. Stainless Steel Bars, Strips, and Sheet Standard Types ☐
5. Valves and Fittings ☐
6. Mechanical Tubing, Carbon, Alloy, and Stainless ☐

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HUDSON WIRE COMPANY

PRODUCERS OF FINE WIRES IN ALL METALS

FINE BARE WIRES

High Brass, Low Brass, Zinc 99.99+ and High Tensile Zinc, Commercial Bronze, Phosphor Bronze, Pure Tin, Lead, Antimonial Lead, Tinsel Lahns, Silver Plated Copper, False Gold and Copper.

Cadmium, Nickel Silver (10%, 18%, 30%), Silver Plated Copper, False Gold and Special Brass and Bronze Alloys to Specification, Metallic Fibre for Packing Purposes, Copper, Bronze, Zinc, Lead and Aluminum.

WIRES FOR METAL SPRAYING

Pure Lead, Lead Alloys, Pure Zinc, Zinc Alloy, Copper, Tin, High Brass, Low Brass, Solder Wire, High Conductivity Electric Wire.

Cadmium, Nickel Silver (10%, 18% 30%), Aluminum, Monel Metal, Phosphor Bronze, Pure Nickel, Commercial Bronze.

Look for the name — **HUDCO** — A guarantee of quality

"HUDCO" specially processed Copper Wire for enamelling purposes is drawn from Selected Copper, insuring the maximum conductivity. This is but one example of the use of the most advanced and approved materials and methods in our processing.

BETTER WIRE AT LOWER COST

Write for Prices and Samples • Let Us Quote on Your Requirements

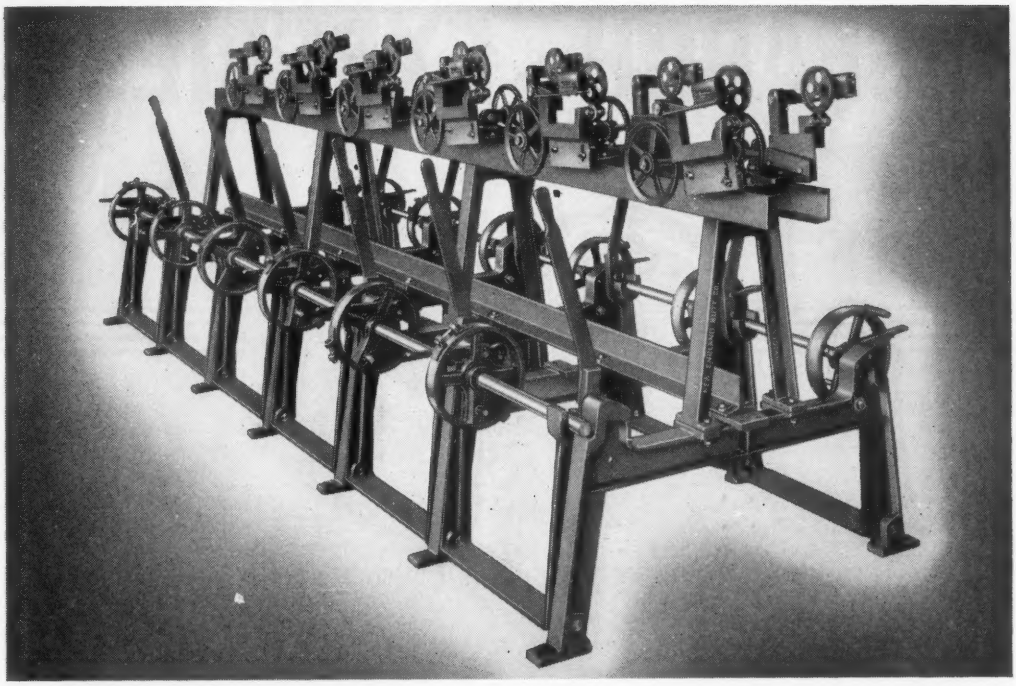
"HUDCO" PLANT AT OSSINING, NEW YORK

HUDSON WIRE COMPANY

Established in 1902 — Successors to Royle & Akin

OSSINING, NEW YORK

MULTIPLE LET-OFFS



BUTT MULTIPLE LET-OFF FRAMES, as illustrated, are used with tinning baths and insulating processes.

Features include:

Reel stands of tilting type for ease of handling.
Adjustable tension on each reel.
Measuring unit on each wire.
Sturdy construction.
Can be supplied with wire straighteners if required.

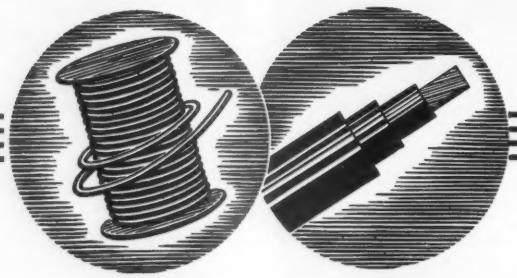
Will handle reels up to 30" diameter by 12" traverse.

WRITE FOR DETAILS

NEW ENGLAND BUTT COMPANY

ESTABLISHED 1842
304 PEARL STREET
PROVIDENCE 7, RHODE ISLAND, U. S. A.
JAMES DAY (MACHINERY) LTD., "FORD HOUSE," 88 REGENT ST., LONDON., W. I. ENGLAND

SPECIALIZED RESEARCH EXPERIENCE



In All Types of Insulating Finishes and Impregnating Materials.

All Formulations made to individual specifications and to meet unusual requirements.

Our Hot-melt, Flame-resistant Compounds are non-toxic.

STANDARD VARNISH WORKS

Engineers of Product Finishes

NEW YORK - CHICAGO

SERVING INDUSTRY FOR 75 YEARS

Better to start with:

WHETHER YOU'RE FURNACE, DIP OR TORCH BRAZING

ALCOA BRAZING MATERIALS

BRAZING WIRE

Alcoa No. 716 Alloy — in 36-inch straight lengths or in coils.

Size Diameter	Feet per pound
1/16"	270
3/32"	120
1/8"	70
5/32"	45
3/16"	30

Also in 0.020" x 2" wide, flattened and slit wire.

BRAZING FLUXES

Alcoa Nos. 30, 33 and 53

8 oz. jar — 1 lb. jar — 5 lb. jar — 50 lb. drum — 150 lb. drum

BRAZING SHEET

A special product with the brazing filler-metal integrally bonded to the sheet.

Alcoa No. 1 Brazing Sheet — one side coated
Alcoa No. 2 Brazing Sheet — two sides coated
} For parts to be Alumilite* finished.

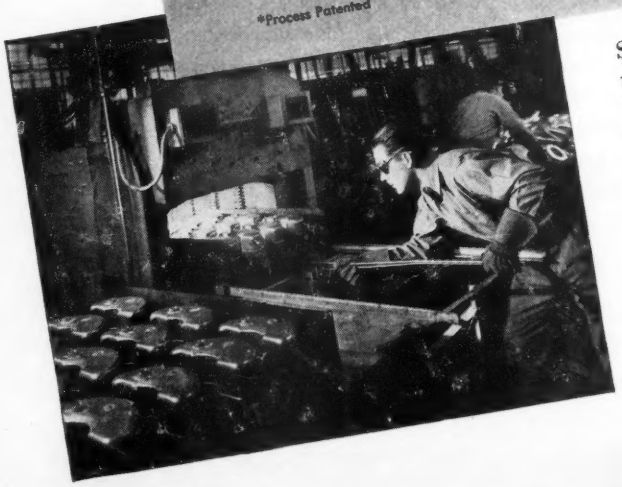
Alcoa No. 11 Brazing Sheet — one side coated
Alcoa No. 12 Brazing Sheet — two sides coated
} For general-purpose brazing.

Alcoa No. 21 Brazing Sheet — one side coated
Alcoa No. 22 Brazing Sheet — two sides coated
} High strength; heat treatable.

Alcoa No. 711 Brazing Sheet — Brazing Coating used on No 1 and 2 Brazing Sheet.
Alcoa No. 713 Brazing Sheet — Brazing Coating used on No. 11, 12, 21 and 22 Brazing Sheet.

All brazing sheet alloys can be supplied in the form of coiled and flat sheet, as well as circles and blanks.

*Process Patented



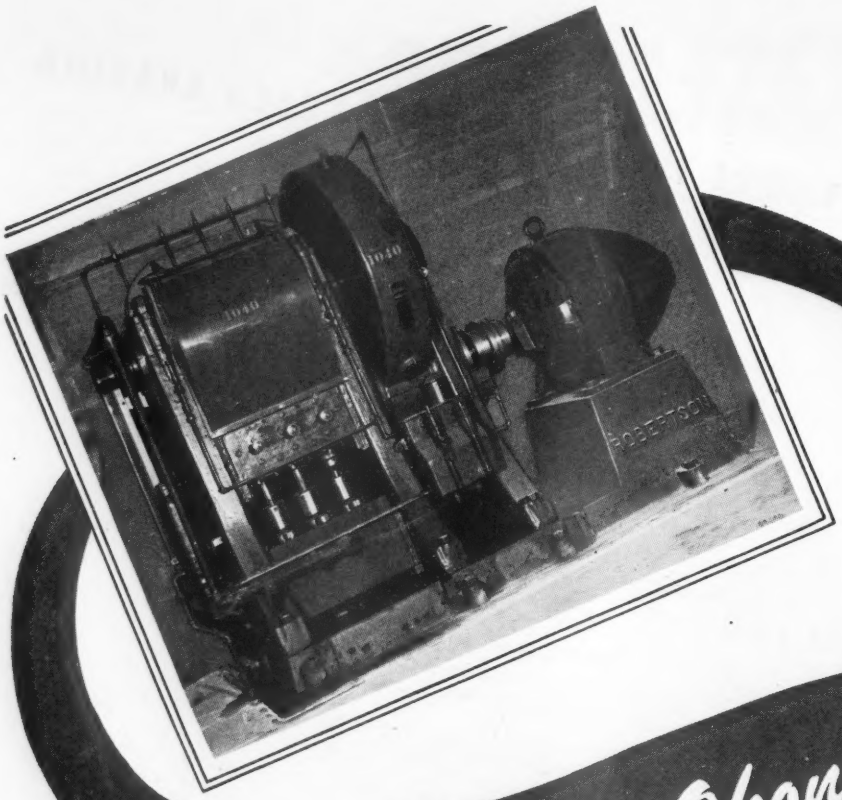
Success of your brazing operations depends upon these factors: Parts must be designed for this method of assembly. Brazing techniques must be correct. Materials employed must be right. Alcoa can advise you on all three—

Our engineers will help you design parts and tools for most efficient assembly by furnace brazing, dip or torch brazing. Alcoa offers you brazing sheet, wire and fluxes backed by know-how gained in years of manufacturing and building aluminum products.

For this help, call your nearby Alcoa office. Or write ALUMINUM COMPANY OF AMERICA, 1828 Gulf Building, Pittsburgh 19, Penna.

ALCOA FIRST IN ALUMINUM

ALCOA REG. U.S. PAT. OFF. ALUMINUM



OKONITE

Ok'd by Okonite

The Robertson 18-gallon hydraulic pump shown above, was recently installed by the Okonite-Callender Cable Company. A leader among cable-manufacturing concerns, whose name has stood through the years for outstanding achievements and finest quality, Okonite knows that to *make* quality products, it is necessary to *employ* quality machinery. Hence, they turn to Robertson Equipment . . . for Robertson equipment is not only "tailored for the job required," but is backed by intensive engineering knowledge and skill.

Robertson equipment includes Extrusion Presses, Hydraulic Pumps, Melting Furnaces and Pots, Die Blocks, Dies and Cores, Hydro-Pneumatic Accumulators, Lead Sheath Stripping Machines and special Hydraulic Packings.

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COMPANY, INCORPORATED

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Designers and Builders of all Types of Lead Encasing Machinery

Since 1858

Talide
(TUNGSTEN CARBIDE)

Performance!

Talide Out-Performs Steel Die 25 to 1 on 5" Alloy Steel Tubing

Here's a recent production report from one of America's largest mills.

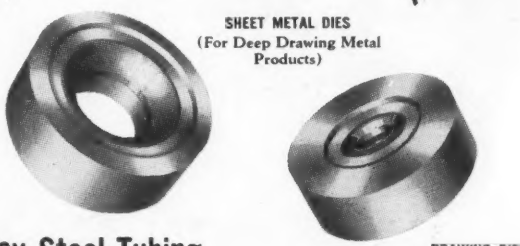
Using a Talide Die instead of a steel die on a cold drawbench, this concern produced 252,000 feet of 5" alloy steel tubing, as compared with the normal run of 10,000 feet with a steel die . . . a production advantage of 25 to 1.

This performance is not phenomenal with Talide. Made from the hardest metal known, Talide Dies stay on the job many times longer than any high speed steel. "Down time" practically disappears, enabling you to establish and maintain profitable continuous production. Scrap and rejections offer no problem because Talide Metal eliminates pickup, scoring and scratching. Equally important, with such products as tubing, these mirror-like dies impart a much higher finish.

Talide Metal is a real cost-cutter. Write for Bulletin No. 43-WP or ask one of our Talide engineers to stop in and show you how you can produce more for less with Talide Metal.

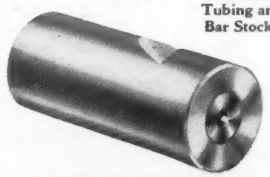
TALIDE METAL
MEETS EVERY REQUIREMENT

Metal Carbides, a pioneer in the carbide industry, makes Talide Dies in all sizes from pin-point up to 24" I. D. Used successfully in all types of manufacturing and fabricating plants for cold drawing or forming ferrous or non-ferrous tubing, bars, wire, or shapes.

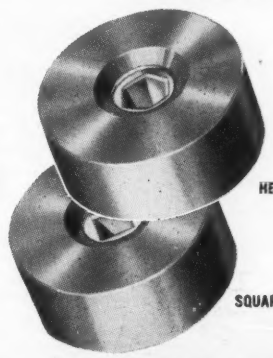


SHEET METAL DIES
(For Deep Drawing Metal Products)

DRAWING DIES
(For Wire, Tubing and Bar Stock)

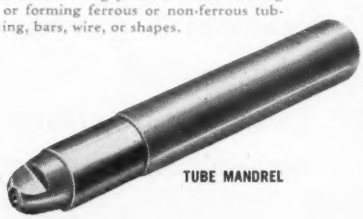


HEADING AND EXTRUSION DIES
(For Shaping and Sizing Bolts, Nuts, Screws, and Rivets)



HEXAGON DIE

SQUARE DIE



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METAL CARBIDES CORPORATION

YOUNGSTOWN 5, OHIO *Pioneers in Tungsten Carbide Metallurgy*

SINTERED CARBIDES FOR CUTTING • HOT PRESSED CARBIDES FOR DRAWING AND WEAR RESISTANCE

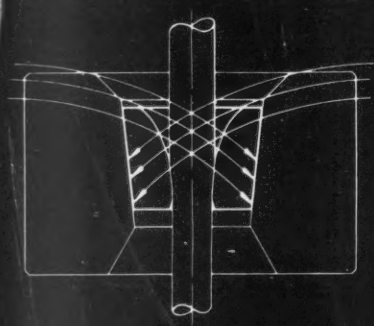
VASCOLOY—RAMET

Tantalum / Tungsten

CARBIDE DIES

For

DRAWING WIRE BAR and ROD

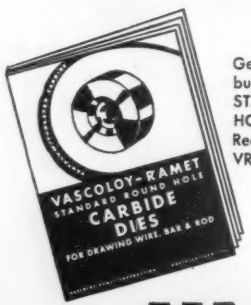


NOTE TAPERED NIB AND CASING

Front and back openings in the new type casing permit easier inspection due to greater visibility.

- Easier to Work
- Greater Strength
- Time and Material Saver
- Better Lubrication
- Full Visibility

Maintain size longer and produce better finish. Tantalum/Tungsten Carbide has a lubricating characteristic which greatly reduces mechanical resistance in drawing, and in so doing, enables a much smoother finish. Many mills report longer productive life, less down time, greater tonnage per die and greater operator satisfaction. Write us for informative Bulletin VR348.



Get this helpful bulletin on STANDARD ROUND HOLE DIES. Request Bulletin VR348.

VASCOLOY Ramet RAMET CORPORATION

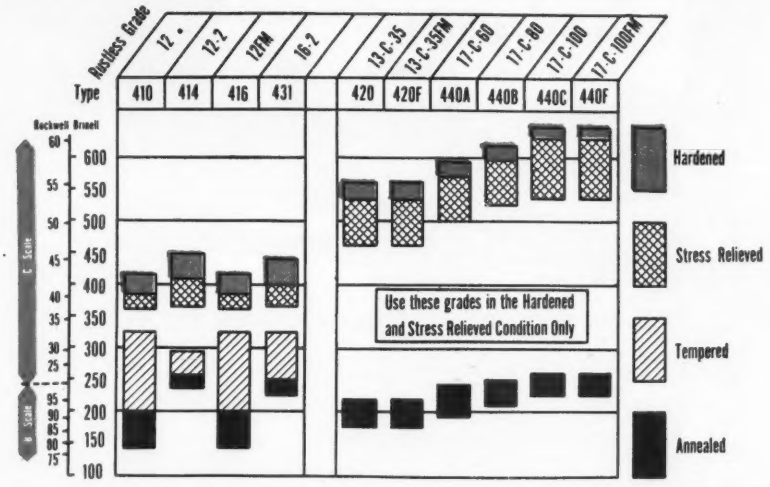
AN AFFILIATE OF FANSTEEL METALLURGICAL CORPORATION AND VANADIUM ALLOYS STEEL COMPANY

NORTH CHICAGO, ILLINOIS • SALES AND SERVICE IN PRINCIPAL CITIES

RUSTLESS DATA SHEET NO. 8

Corrosion Resistance Plus Hardness By Heat Treatment

One of the Many Combinations of Properties Offered by Stainless Steels



THERE are 29 standard grades of stainless steels . . . some are hardenable by heat treatment . . . some contain nickel . . . all contain chromium. This variation in composition and response to heat treatment divides them naturally into three distinct groups.

Group I . . . Chromium. Hardenable by heat-treatment.

Group II . . . Chromium. Hardenable slightly by cold work only.

Group III . . . Chromium-nickel. Hardenable only by cold work.

Stainless steels included in Group I are the only grades which respond to hardening by quenching, stress relieving and tempering operations in a manner similar to carbon and low alloy steels. The most commonly used Group I grades and their response to heat treatment is shown on the above chart. Highest hardness is developed with Type 440C which is used for applications requiring wear resistance, such as balls and ball bearing races. Type 440F, the free-machining counterpart of Type 440C, is used for valves and other parts requiring extreme hardness plus good machinability. Types 420, 440A and 440B develop hardness values ranging from a minimum of 450 Brinell for Type 420 to a maximum of 600 Brinell for Type 440B. They are used for products such as surgical instruments, valve seats, cams and carving knives. Type 420F is the free-machining counterpart of Type 420. Types 410, 414, 431 contain less carbon, develop slightly less hardness, but provide greater protection against corrosion, particularly Type 431 which has the best corrosion resistance of any in this group. In general, corrosion resistance increases with the chromium content and decreases as carbon content rises. The lower carbon grades are used extensively for turbine blades, cold-headed screws, bolts, pistons, pump rods and many other products. Type 416 is the free-machining counterpart of Type 410. It is widely used for high speed machining operations on automatic equipment.

Hardening the Group I alloys is accomplished by heating above the critical or transformation temperature and rapidly cooling in air or oil. Water quenching is not a good practice and is likely to produce quench cracks, especially with the high carbon grades. Hardening should always be immediately followed by a low temperature treatment (300°-700°F.) to relieve stresses developed in quenching, particularly the high carbon grades. A wide range of tensile and hardness properties can be secured by tempering Types 410, 414, 416 and 431. The higher carbon types should be used only in the hardened and stress relieved conditions because of the adverse effect tempering has on their corrosion resistance. When you want to know more about the heat-treatment of stainless steels, consult Rustless Division of ARMCO.

For complete information on the heat treatment of all stainless grades, request a copy of Rustless' comprehensive and widely read 58 page book "Heat Treatment of Stainless Steels". If you merely need handy reference charts on some particular grade — for use under your desk top or in the shop—send for copies of Rustless' "Heat Treatment Data Sheets".

Rustless

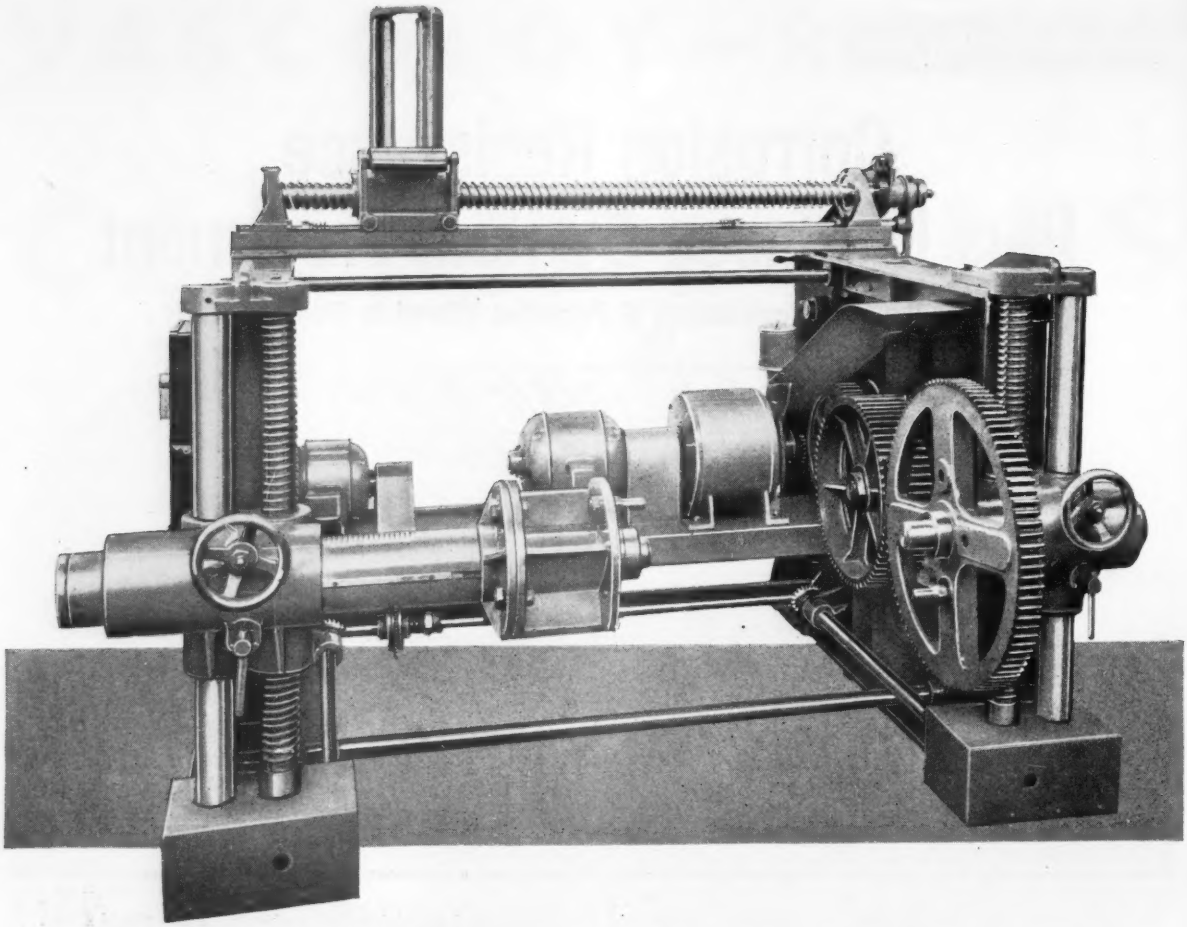
DIVISION OF ARMCO

RUSTLESS IRON AND STEEL DIVISION

THE AMERICAN ROLLING MILL COMPANY

Baltimore 13, Maryland

STAINLESS STEEL SPECIALISTS



Syncro Cable Take-Up.....
with choice of drive.

The arbor centers of the Syncro Cable Take-Up are adjustable. The driving gears are constantly in mesh so the arbor centers can be raised or lowered to suit the reel diameter while the Take-Up is operating. The simple traverse mechanism provides adjustable stroke and pitch to accommodate various cable diameters, and the stroke and pitch can be changed while the unit is operating.

The drive can be either motor operated magnetic slip clutch — which maintains uniform tension during entire reeling of cable — or any other suitable electric drive.

Syncro Cable Take-Ups are built in various sizes to accommodate standard reels.

Write for complete information.

SYNCRO MACHINE COMPANY

REPRESENTED IN CANADA BY
CANADIAN ELEVATOR EQUIPMENT CO,
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EXECUTIVE OFFICES AND GENERAL WORKS—611 SAYRE AVENUE, PERTH AMBOY, N. J.

Machinery for the Wire Industry

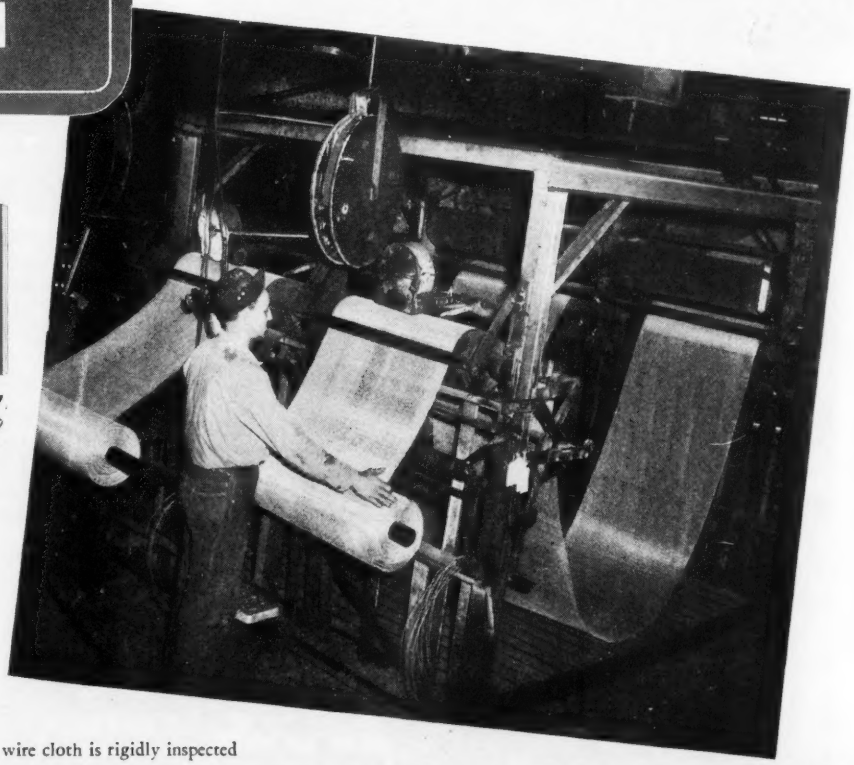
SYNCRO

Progressive RESEARCH...

that benefits the user

Reynolds *Industrial* **WIRE CLOTH**

From the day the first Reynolds wire cloth was woven fifty-two years ago... the founder's spirit of research has never flagged. Research has been continuous... ever growing in intensity. Reynolds laboratories have originated and successfully developed many important improvements in the wire cloth field. If yours is a special problem consult Reynolds industrial wire cloth specialists, free of charge, and without any obligation.



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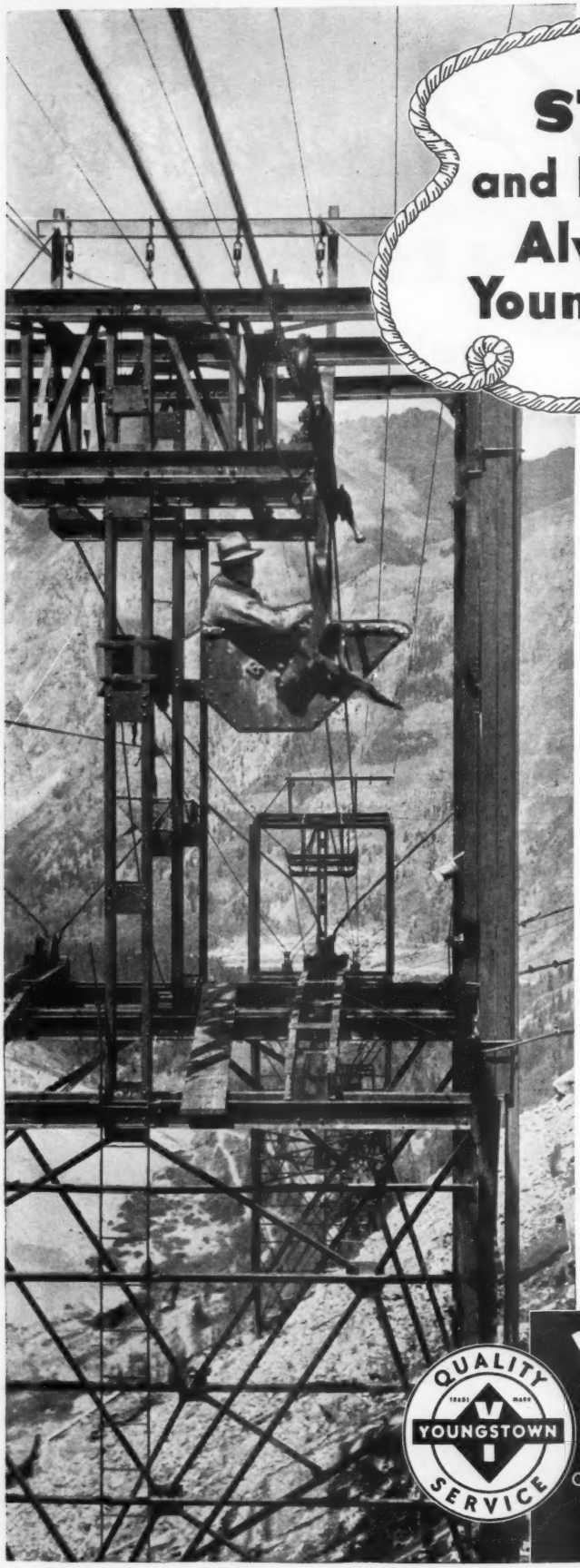
This new 32-page catalog is complete and easy to use. A request on your company's letterhead, or your card, brings you a copy postpaid.

FREE for the asking

Reynolds industrial wire cloth is rigidly inspected

REYNOLDS WIRE CO., DIXON, ILL., **CHICAGO OFFICE: 332 So. Michigan Ave.**



STRENGTH and FLEXIBILITY Always "*Firsts*" in Youngstown RopeWire

On aerial tramways

AERIAL tramways span gorges, cross rivers, bridge roadless mountain slopes--to carry ores, precious minerals, waste rock, even men. Their construction and operation require thousands of miles of wire rope.

Usually located on difficult terrain, frequently in almost inaccessible spots, a tramway breakdown disrupts production, is costly to repair. That means the wire rope must be good. Strength and flexibility are "firsts," as are also toughness to resist abrasion and ability to resist corrosion.

These important qualities are imparted to wire rope by the wire from which the rope is woven. In Yolectro High Carbon Rope Wire, these qualities are built into the product--closely controlled and guarded at every step of manufacture, from the moment steel is poured from the open hearth clear through the final inspections.

Yolectro High Carbon Rope Wire, like all other Youngstown wire mill products, is of finest quality steel, refined, rolled and drawn to exacting specifications.

Photo—Courtesy Preformed Wire Rope Information Bureau.

QUALITY TRADE MARK YOUNGSTOWN SERVICE

YOUNGSTOWN

THE YOUNGSTOWN SHEET AND TUBE COMPANY

GENERAL OFFICES - YOUNGSTOWN 1, OHIO

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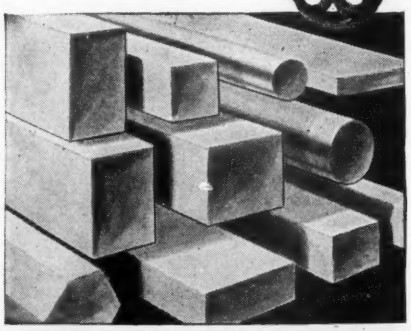
Manufacturers of

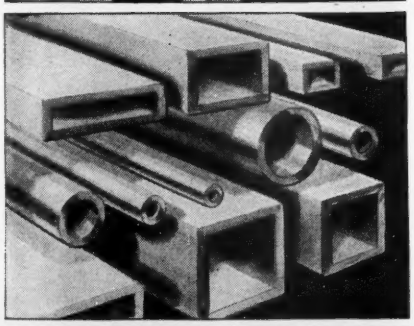
CARBON - ALLOY AND YOLOY STEELS

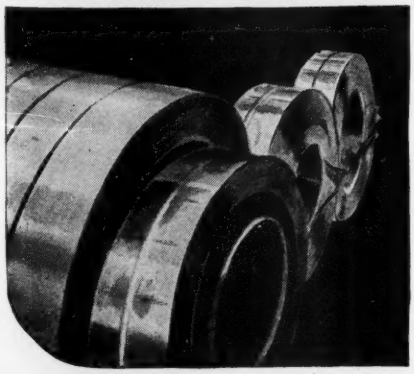
Bars-Rods-Wire-Cold Drawn Carbon Steel Rounds-Electrolytic Tin Plate-Coke Tin Plate-Pipe and Tubular Products-Sheets - Plates - Conduit - Tie Plates and Spikes.

NOW

Brass Mill Products Quickly!







A large supply of brass mill products is now offered to the trade at unusually low prices. The entire inventory may be fabricated by normal production methods and is being sold in production quantities.

The inventory includes: Free Turning Brass Rod—1 inch diameter and larger; Copper and Brass Tubing—3 inch O.D. and larger; Naval Brass Rod—various diameters; Aluminum Bronze, Manganese Bronze and Silicon Bronze in various shapes.

• • •

This material is offered in the following sequence as provided by law: (1) Certified Veterans of World War II; (2) Subsequent priority claimants; (3) Non-priority purchasers. Federal agencies have had opportunity to fulfill their needs. VETERANS OF WORLD WAR II should apply to their nearest WAA Regional Office for certification; the case number assigned and the location of the certifying office must be stated in a Veteran's offer to purchase.

EXPORTERS: The War Assets Administration solicits your inquiries. Communicate with your foreign clients promptly.

WAR ASSETS ADMINISTRATION

Offices located at: Atlanta • Birmingham • Boston • Charlotte • Chicago • Cincinnati • Cleveland • Dallas • Denver • Detroit • Fort Worth • Helena • Houston • Jacksonville • Kansas City, Mo. • Little Rock • Los Angeles

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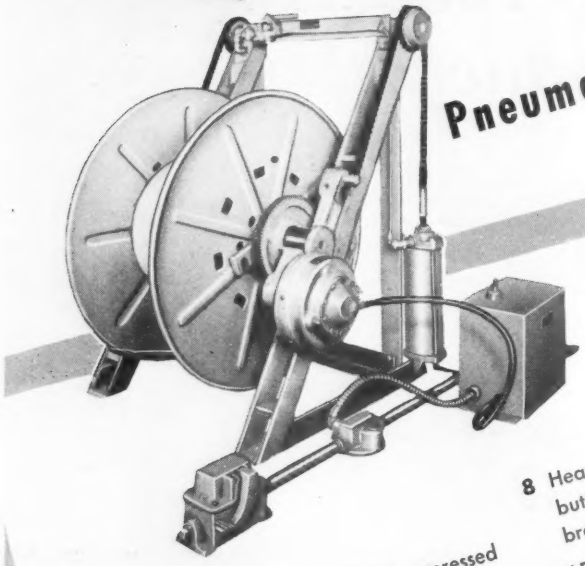
157-8A

JLE

PAY-OFF REEL STAND EQUIPMENT

featuring

Pneumatic Lift and Air Brake!



1 Reel is raised and lowered by compressed air—no back-breaking work on part of the operator (permitting female operation).

2 Air line has speed-control valve and a check valve to prevent false operation in case of air failure.

3 Reel dog-shaft is equipped with enclosed ball-bearings on gear end.

4 Air brake is 100 ft. lb. capacity, has 5 to 1 gear advantage. Equivalent of 500 ft. lb. braking power on the reel.

5 Brake is equipped with adjustable drag, allowing tension in wire if desired.

6 Brake shaft is mounted in enclosed ball-bearings.

7 Lift shaft and guide rollers are equipped with needle-bearings.

8 Heavy, cast-iron, foot-operated, push-button station is furnished to release brake.

JLE Pay-Off Equipment is made in FOUR SIZES to handle maximum reels, as follows: 36", 48", 60", 72" O.D. Each size will take reels from maximum to approximately one half maximum O.D.

Also, JLE Pay-Off Equipment is made for several capacities in each size to accommodate different maximum weights of reels. The equipment is also available without the air brake, if desired. A Solenoid-operated brake can be furnished where no compressed air is available.

JLE Pay-Off Equipment is for use in any wire mill where unreeling or pay-off operations, such as pay-off for wire drawing, continuous vulcanizing, plastic extruding, reeling, coiling, saturating, finishing, etc. take place.

JAMES L. ENTWISTLE CO.

43 CHURCH STREET, PAWTUCKET, RHODE ISLAND

World's Leading Manufacturer of Spark-Testing Equipment

Canadian Representatives:
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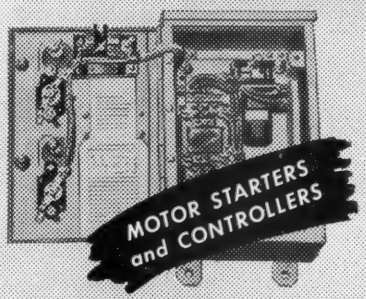
ELECTRICAL SUPPLIES

for

JOBBERS–CONTRACTORS–INDUSTRY

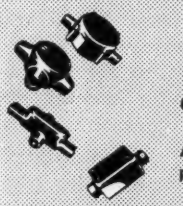


General Electric, Westinghouse, Cutler-Hammer, Ward Leonard and other makes, built to both commercial and Navy specifications. 115 and 230 volt DC; 220 and 440 volt AC; 60 cycle, 3 phase. Drip-proof, water-proof, manual and magnetic types. Unused and used.

ATTACHMENT PLUGS
Composition and rubber in a variety of grips. Fine quality.

CONNECTOR BODIES
Bakelite and composition, parallel slots, "T" slots, rugged construction.

KNIFE SWITCHES
Fuse, non-fuse — 2 and 3 pole — single and double throw.



CONDUIT FITTINGS
All types, for all purposes.

The electrical supply items shown here are but a fraction of the total surplus inventory. Use the coupon to indicate other items in which you are interested.

A huge inventory of government surplus electrical supplies is now available to dealers, jobbers, contractors and industrial users. Many scarce items are included in this sale—items which continue to be in short supply and are now offered at prices well below today's market for similar products.

***Act Now*—secure needed supplies and build up depleted stocks. Simply fill in the attached coupon and mail to your nearest War Assets Administration Regional Office.**

Send this coupon to your nearest WAA Regional Office:

I am interested in the following:

ITEMS	*DESCRIPTION*
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691-3

All electrical supplies are subject to priorities. VETERANS OF WORLD WAR II are invited to be certified at the War Assets Administration Certifying Office serving their area and then to purchase the material offered herein.

EXPORTERS: The War Assets Administration solicits your inquiries. Communicate with your foreign clients promptly.

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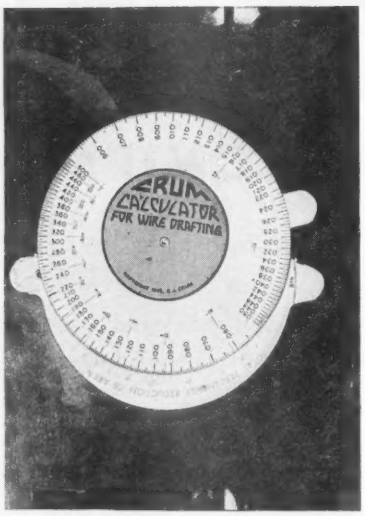
Offices located at: Atlanta • Birmingham • Boston • Charlotte • Chicago • Cincinnati • Cleveland • Dallas • Denver • Detroit • Fort Worth • Helena • Houston • Jacksonville • Kansas City, Mo. • Little Rock • Los Angeles • Louisville • Minneapolis • Nashville • New Orleans • New York • Omaha • Philadelphia • Portland, Ore. • Richmond • St. Louis • Salt Lake City • San Antonio • San Francisco • Seattle • Spokane • Tulsa

691-3

The Crum Calculator for Wire Drafting

Provides answers simply and accurately for a given mathematical wire drafting problem. One setting shows number of holes, percentage of draft per hole, total reduction in area and intermediate die sizes to be used. Covers drafting range of .500″ to .005″. Accurate enough for most mill conditions.

* * *



Simple to operate; compact enough to carry in vest pocket; can be used for Metric as well as English systems; all diameters given in decimals. A handy and time-saving device that will eliminate time-wasting and possible errors in calculations.

* * *

EXAMPLES OF PROBLEMS SOLVED QUICKLY BY USE OF THE CALCULATOR

PROBLEM No. 1

DETERMINE the reduction of area in drawing ¼-inch diameter rod to .120 inch wire.

PROBLEM No. 2

SUPPOSE that in Example 1 the tensile strength of the stock is such that the drawing process produces a tensile strength of 100,000 pounds per square inch in the .120 inch wire. To develop the same tensile strength in an .080 inch diameter wire, what stock size is required when the tensile strength of the stock is assumed to be the same as that in Example 1.

PROBLEM No. 3

IN the drafting of .0625 inch diameter wire to .025 inch, no single draft must exceed 21 per cent. Determine the minimum number of holes for this job.

* * *

THE Crum calculator is designed especially for wire drawing jobs involving eight or fewer drafts. Problems involving a greater number of drafts can be solved, however, with extra manipulation. For instance, if it is desired to set up a multi-draft machine to draw .0095 inch diameter wire from .0625 inch stock in sixteen drafts, the intermediate die sizes can be determined by the calculator.

PROBLEM No. 4

A CERTAIN five-block continuous wire drawing machine has a capacity permitting a draft of 33 per cent per hole on low carbon wire. For economic reasons it is desired to find the largest stock size that can be used when finishing .0455 inch diameter wire on this machine.

* * *

PROBLEM No. 5

A continuous machine is to be set up to draw .0375 inch tire bead wire six holes from .122 inch diameter stock. All drafts are to be equal in percentage reduction of area. Determine "a" the intermediate die diameters; "b" the per cent reduction of area per hole; "c" the total per cent reduction of area from start to finish.

PROBLEM No. 6

THE diameter of the finishing block of a double-deck wire drawing machine is twenty-four inches; the diameter of the first block, seventeen inches. The operator wishes to finish .142 inch diameter wire from No. 5 rod and therefore must determine (a) the minimum draft for the finished die, (b) the minimum first die size, (c) and the first die size when a slippage of ten per cent is allowed.

* * *

HOW TO ORDER

The price is $5.00 each. A discount of 10% on ten or more.

Send check or purchase order to

WIRE AND WIRE PRODUCTS

300 MAIN STREET **STAMFORD, CONN.**

The Wire Outlook

Abraham Lincoln laid down a basic principle for Americanism when he stated that the country could not exist half slave and half free.

Slavery has reared its ugly head in this country in many forms and possibly no element in our complex society has been entirely free from offense at one time or another. Just now may be noted two dominant forms of slavery—that of labor and industry by labor leadership, which although observing the form of democracy, nevertheless in fact is an absolute dictatorship; the second is that of the limitations imposed on all society by Government controls covering some sixty percent of all of the goods consumed by industry and the public, in which we see controls continued for control's sake.

Besides being still burdened by strikes, industry is forced from time to time to shut down for lack of materials, the shortages of which are primarily induced by un-needed, un-wanted and un-wise Government-imposed controls. Only when the Government substitutes freedom of industrial action for the powers possessed by various bureaus, will sustained production, lower prices and higher wages be possible. Living standards do not rise by control and limitation—they are lifted by a plentiful supply of goods made through efficient capacity production.

There is no lack of orders—backlogs are high in every direction. The steel industry is well into the third quarter with bulging order books.

A critical shortage of rods continues to restrict the output of non-integrated wire producers, with little hope that the prospect will be improved until early in 1947. Galvanizing facilities are inadequate to handle the load imposed by current demands.

Spring wire continues in heavy demand for farm machinery, automobiles and other uses. Nails are still short of the requirements of the housing program and at this writing the C.P.A. is discussing a six-month subsidy to encourage nail production, which will require 835,000 tons in 1947. Production has been running about 66,000 tons a month.

Cold headed product manufacturers are emphasizing those fasteners that may be made from the smaller sizes of wire on which a profit may be made, but the shortage of wire and rods limits overall output. Backlogs average about seven months. Merchant and manufacturers wire items will absorb about half of the first quarter output.

Tin continues short, as we depend almost entirely on imports for our supplies. This year's imports will run approximately 42,000 tons against essential requirements of about 65,000 tons.

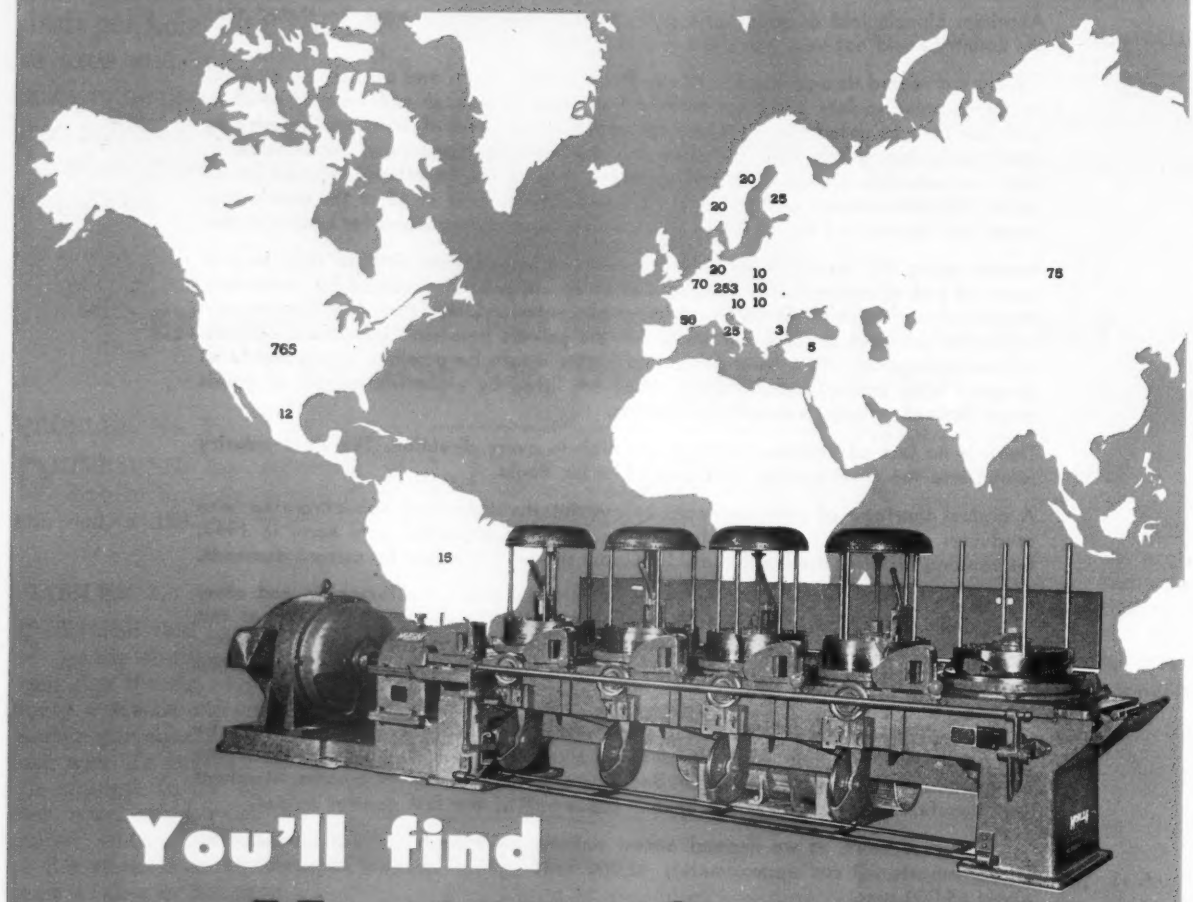
Lead supply continues to be the most critical of the non-ferrous metals, but growing lead imports are expected to ease the situation in this last quarter. Zinc production is still plagued by price controls, which affect output. Mills are operating with the lower spelter inventories they have had in years.

Copper production and deliveries are improving due to the re-opening of mines and the release of some 55,000 tons from the Metal Reserves stocks in August. 1947 should see a material improvement in the supply of this metal for all purposes.

There is nothing in the whole list of shortages of basic metals that the removal of Government controls would not ameliorate.

—from the Editor's Desk

Wherever Efficiency is a Factor . . .



You'll find Morgan-Connor Wire Machines

Because they increase production, reduce die costs, require less power, less space

MORGAN CONSTRUCTION CO.

WORCESTER, MASSACHUSETTS, U. S. A.

WM-1

WIRE AND WIRE PRODUCTS

A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable.
DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

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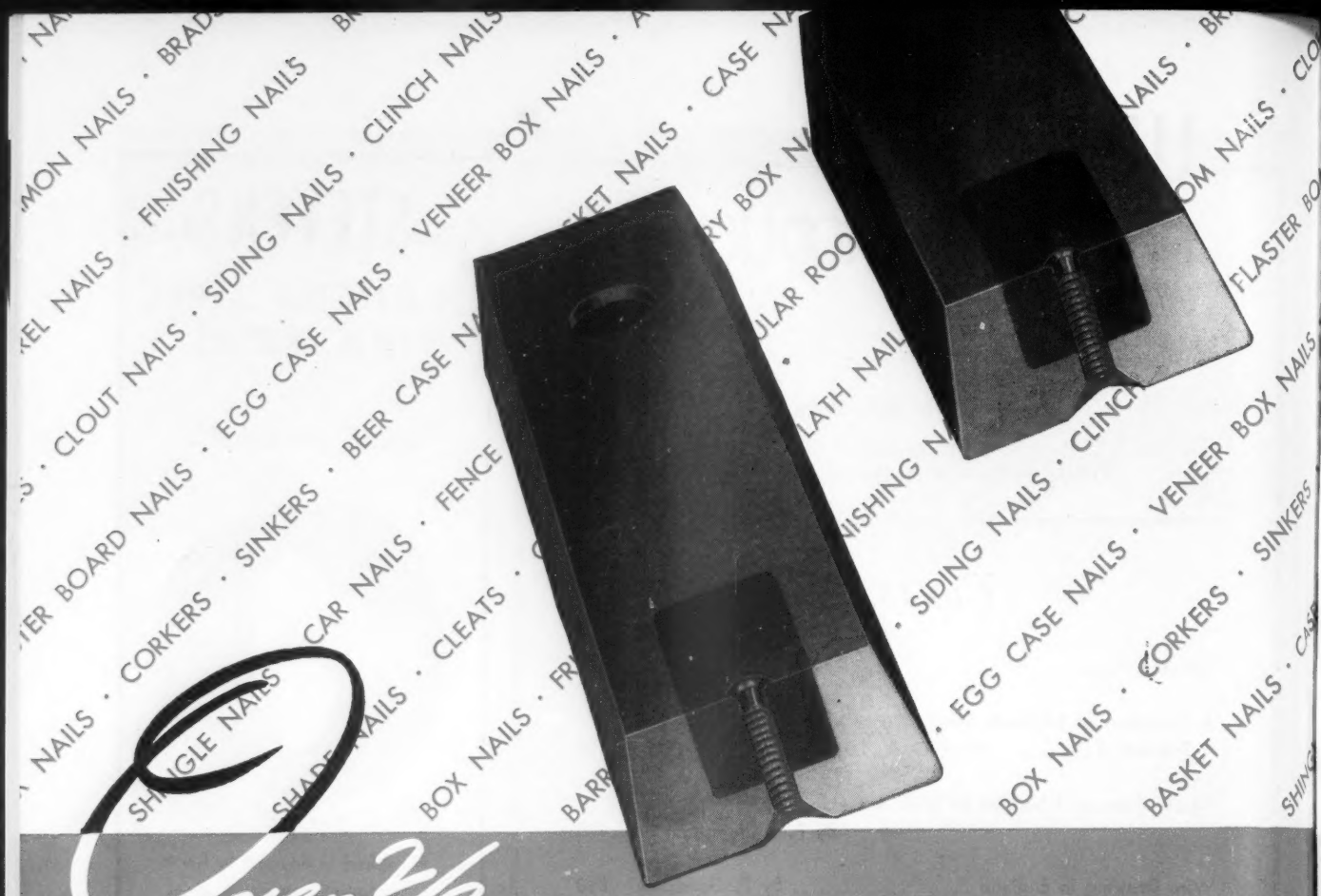
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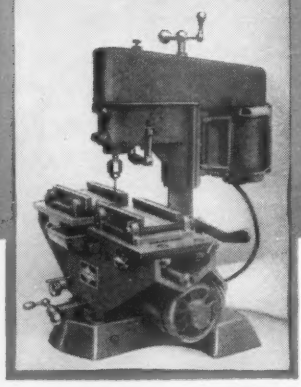

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DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 21 NOVEMBER, 1946 No. 11

A Selection of Methods for Polishing Metallographic Specimens

by

Freeman G. Anderson and Roy E. McGraw

Chief Metallurgist Metallographist

National Lock Company,
Rockford, Ill.

The consideration of sample preparation for metallographic examination. A paper presented before the Wire Association, Buffalo, N. Y., October, 1946. ★ ★ ★ ★

IN considering sample preparation for metallographic examination it is perhaps foolhardy to strive for complete perfection. Yet that is the goal, and an element of dissatisfaction exists so long as perfection is not attained. From the standpoint of perfection, the writers are highly displeased with the method chosen. However, with an appreciation of imperfections in all fields of human effort and with an understanding of practical limitations, the advantages of the method to be outlined are immediately recognized. Indeed after many years of forced contentment with scratched and pitted samples the authors now have a high regard for the present method. Hope for justification in this presentation lies in the belief that other laboratories may still be in search for improved polishing technique and that the procedure to be given may prove helpful to them.

★ ★ ★

SINCE **Sorby** introduced the use of the microscope to the study of metallic structures there have been many and sundry methods of polishing described in the literature. Most noteworthy were those written by **Boylston, Wohrman, Lucas** and **Villela**. The results of their methods were in each case well illustrated with photographs to prove the success of their polishing technique. As a matter of fact, it is well for anyone attempting to improve his method or change his practice, to read and re-read the works of these authors, fixing in mind the illustrations of workmanship as standards to approach rather than to improve. Unfortunately in each method there appeared an indescribable feature known as the "art of polishing," which to many metallographers becomes a problem quite impossible to master.

★ ★ ★

AS a striking example of demonstrating the "art of polishing" the writer recalls an experience that occurred some fifteen or more years ago. A large shipment of steel had been rejected on the basis of excessive non-metallic inclusions or "dirty steel." Photomicrographs were sent to the mill to illustrate the condition. The supplier, however, immediately recognized the fact that the photographs illustrated pits instead of inclusions and soon proceeded to prove this point. But to do so, to the customer's satisfaction, it was necessary to re-polish the same sample on the same equipment. Only the usual emery papers and a single polishing disk was at hand. To make it more difficult, a soft long nap flannel cloth was used. Nevertheless, the mill metallographist succeeded, without delay, to free the sample of pits and scratches and to prove that only a few impurities were actually present. It is amazing that such skill could ever be developed, and for lack of ability to acquire the "art" when using emery paper and soft nap cloths, the writers have searched for other materials and methods ever since.

★ ★ ★

IN the **A.S.T.M.** and **A.S.M. Handbooks** we find reference to such items as emery papers, lead laps, paraffin wheels, paraffin impregnated billiard cloth or canvas, silk, satin, broadcloth, etc., also various abrasives, each having a part or alternate part in progressively removing scratches. Probably the clos-

est approach to a fully recommended practice, particularly for the study of inclusions in steel, is to start by grinding or filing, followed by successive steps on emery papers numbers 1, 0, 00, and 000, then on paraffin impregnated cloth with 600 grit abrasive followed by final polish on a low nap fabric such as silk. Even by this method one who is not skilled in the art will find his sample pitted and scratched, not to mention that the surface will probably contain an abundance of strained or disturbed metal to obliterate the true structure.

* * *

FROM the list of materials mentioned above the writers have chosen only the lead lap with coarse emery abrasive and the paraffin wheel with 600 grit abrasive. For final polishing a synthetic cloth has been chosen. Each of these three will be described in detail later.

* * *

EMERY papers have been eliminated entirely, so that after filing or grinding the surface to be inspected, only three steps are necessary. The first step is grinding on the lead lap; the second step is to semi-polish on the paraffin wheel and the third step is final polishing on the synthetic cloth. While this method then does reduce the number of operations, it is not to be implied that elimination of operations is all important. However, there is the advantage that there are fewer transfers of position and less time lost when cleaning the sample and washing the hands between operations.

* * *

The Lead Lap

THE lead lap as illustrated in figure 1 is made according to the directions of its originators, **G. A. Ellinger** and **J. S. Acken** from the **Bureau of Standards.** Actually the material is solder instead of lead. Either the 50-50 or 70-30 grade may be used. A conventional 8″ diameter polishing disk as ordinarily used for cloth polishing is set level and a metal band is clamped around it to form a side wall ¼″ high. To prevent leakage of liquid solder at the joint of the band a small asbestos string serves well as a stuffing. The solder is melted by playing a flame from a Bunsen burner directly against the top of the disk and adding solder until a pool about ¼″ deep is obtained. After cooling, the band is removed and the disk set up in a lathe to cut the top face smooth, flat and square with respect to the driving shank. The grooves are cut with a 60° milling cutter 1/16″ deep to form numerous chords instead of radii or spirals. The grooves are about ¼″ apart and at 90° of one another to form numerous ¼″ squares. A new wheel may need some de-burring with a knife and a stiff scrub brush.

* * *

INSTEAD of using the lead lap for fine grinding as its originators intended, it is used for coarse grinding. By applying American Optical 302 emery with water (1 teaspoonful of emery in 200 c.c. of water) directly on the rotating wheel while a specimen is lightly held against it, the solder soon becomes impregnated and will not show signs of wear until several hundred samples have been prepared, after which it can again be faced level without need of re-grooving. After two or more re-facing it can again be re-grooved without cutting through the solder. Thus it is apparent that such a wheel will give extended service.

* * *

DURING the rough grinding stage the lead lap is kept wet by rather frequent application of the water and emery mixture. Dispensing to the wheel is done from a 250 c.c. **Erlenmeyer** flask having a one hole rubber stopper fitted with a short piece of drawn glass tubing. The specimen is slowly moved across the wheel to various diameters of the grinding path. It is optional with the operator as to whether the sample is given a twisting motion to produce random directional scratches or to hold the sample in such a manner that parallel scratches are produced. The twisting method conforms to the general practice of flat lapping but has the disadvantage of leaving less visible evidence of scratch removal in the next step. In either case, grinding progresses very rapidly without pressure on the sample and the file marks or original grinding scratches are quickly removed. Vertical vibration should be kept to a minimum. Wheel speeds between 200 and 600 R.P.M. have been found satisfactory.

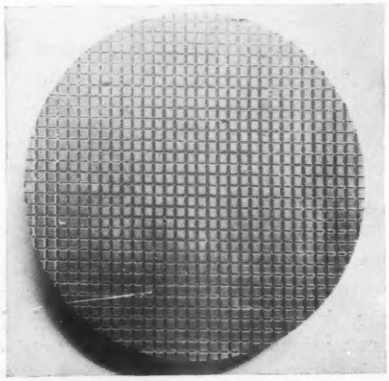


Fig. 1. Top face of lead lap illustrating method of grooving.

* * *

THE principal advantage in using the lead lap is that a very flat surface is developed. The sample and the mounting material are both cut evenly in the same plane, so that no time is lost in the next step, which also finishes to a very flat surface. Aside from this fact there is no advantage over emery paper, as the finish derived is probably no better than number 00 paper.

* * *

The Paraffin Wheel

THE paraffin wheel is radically different from those usually described in the literature. Instead of using a smoothly cut surface with grooves, a naturally rough surface is produced by inherent solidification properties of two grades of paraffin having different melting points. Because the success or failure of the operation of the wheel depends on its surface irregularities, it is really quite necessary to accurately follow some simple directions for making the wheel.

* * *

IN the first place a brass or bronze disk (not aluminum) must be used. A retainer band is permanently fastened to the disk to hold a ¼″ deep pool of molten paraffin. The disk is carefully levelled so that rotation is in a true horizontal plane. Two parts of hard paraffin (M.P. 68 to 72° C.) and one part soft parawax is melted in a suitable con-

tainer and poured onto the disk to the ¼" thickness. After the paraffin and the disk have cooled to room temperature the paraffin is again re-melted by playing a long flame from a Bunsen burner against the surface of the paraffin. All of the paraffin must be re-melted but as soon as the disk is clearly visible over its entire area the flame is immediately removed and allowed to cool in still air to room temperature. The melting time is about 10 minutes and the cooling time about one hour. If these instructions are carefully followed a surface will develop that has numerous small round projections or "pimples" of uniform height as illustrated in Figure 2. Incomplete re-melting produces a surface that is too smooth and overheating causes large wavy projections that are quite unsatisfactory.

* * *

THIS wheel may also be operated at speeds ranging between 200 and 600 R.P.M. Because it is desirable to maintain the small projections on the surface of the wheel it is important to bevel the edges of the sample mount so that there is no danger of scraping the surface with any sharp edges. However, after continued use the small projections will become flattened slightly and the wheel will fail to grind regardless of the amount of abrasive applied. It is then only necessary to scrape the surface reasonably clean and re-melt and solidify the paraffin as before. Remelting can best be done at the end of the day for overnite cooling.

* * *

THE abrasive used on the paraffin wheel is one teaspoonful of 600 grit carborundum to 200 c.c. of soap solution. The soap solution is 50 grams of green oil soap per liter of water. The same method of dispensing is used as for the lead lap. Likewise the sample is slowly moved across the wheel and again it is optional for the operator to use a twisting motion for random directional scratches or to hold to parallel scratches. In either case it is necessary to completely remove the scratches previously produced by lead lapping. It is well to inspect

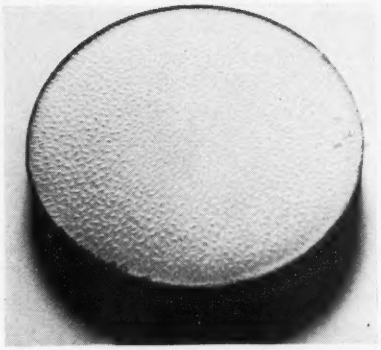


Fig. 2. Top surface of paraffin wheel. Note small round projections or "pimples" developed during solidification.

the surface condition microscopically to be certain that the bottoms of previous scratches are completely removed before proceeding to the final polish.

* * *

Final Polish

AS stated before, a synthetic cloth, introduced and sold to metallurgical laboratories by **Fisher Scientific Co.** under the trade name of **Gamal cloth**, is used for final polishing. There have been other

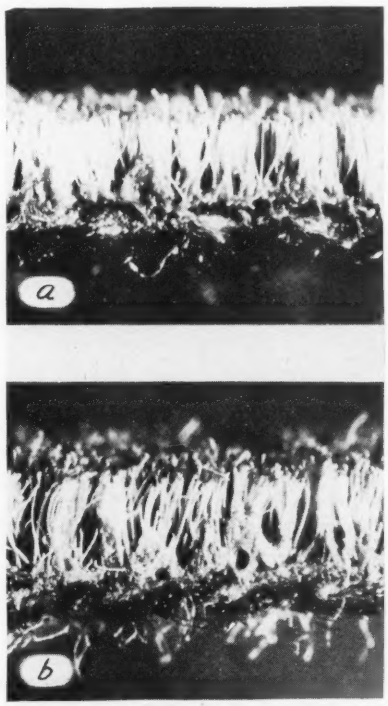


Fig. 3. (a) Edge view of "Gamal" polishing cloth. X 20. — (b) Edge view of "Celluseude" polishing cloth. X 20.

manufacturers of identical material but due to scarcity of plastics during and immediately following the war, all manufacturers have been unable to produce this product. However, in the near future other trade names for this material may be forthcoming and for this reason a brief description follows for the purpose of identity and recognition.

* * *

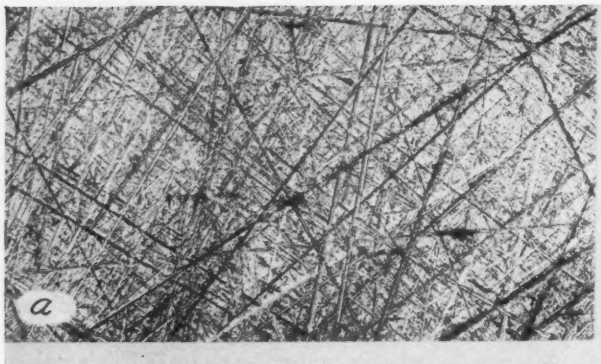
THE flock or nap is rayon fibre approximately .0008" in diameter and pre-cut to 1/32" length. A dense pile is electrostatically driven into a layer of either rubber cement or vinyl butyral that has been evenly spread over the base cloth. Figure 3 illustrates the appearance of an edge at low magnification. Figure 3a is Gamal and Figure 3b is a similar grade made at Rockford, Illinois, but which was intended for other purposes. The two cloths served equally well as their similarity in the photographs would indicate.

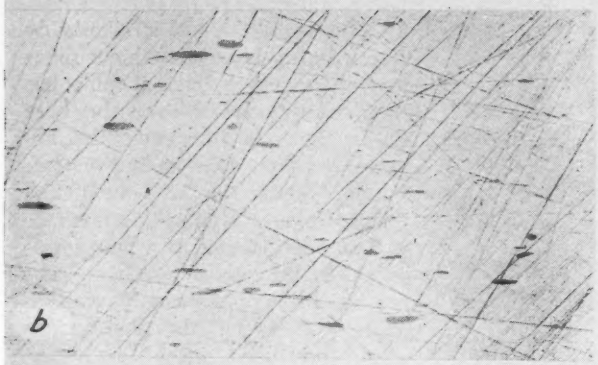
* * *

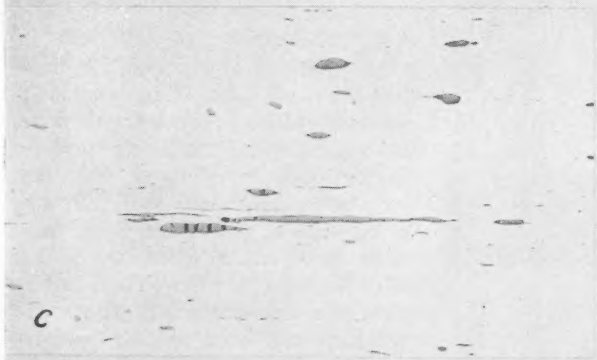
WHILE this type of cloth is quite ideally suited for final polishing of both hard and soft steels it can be produced with finer or coarser and with shorter or longer naps, as desired. For the very soft non-ferrous metals it appears that a still finer flock possibly made from nylon would be advantageous in order to more completely avoid scratching. The writers have not been able to investigate these possibilities as yet due to the scarcity of materials as previously mentioned.

* * *

THESE synthetic cloths have several distinct advantages over other woven materials. The fact that they are water proof is a desirable feature because abrasives do not filter through and pile up under the cloth. The nap itself never becomes water soaked nor changes in physical characteristics when wetted. With light pressure on the sample there is an even pull instead of the stick and slip action that so frequently jerks the specimen from the operator's hand when using other cloths. Nor does the cloth load up with abraded metal from the specimens. It polishes







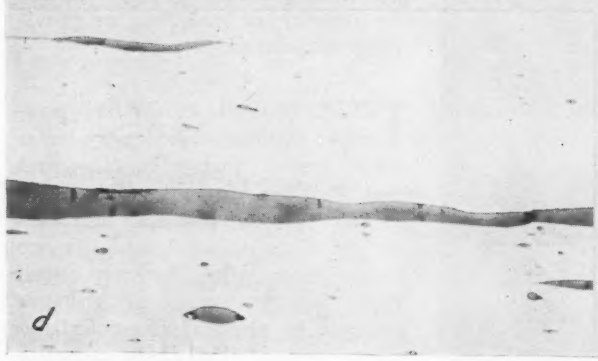
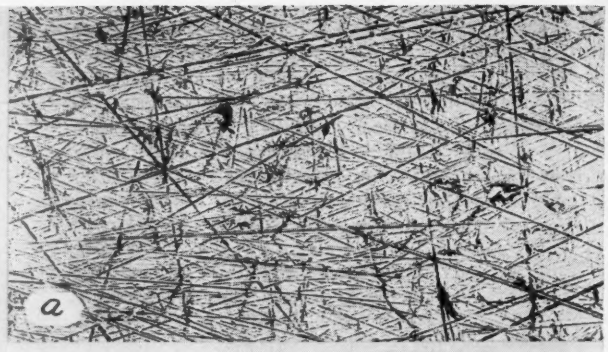
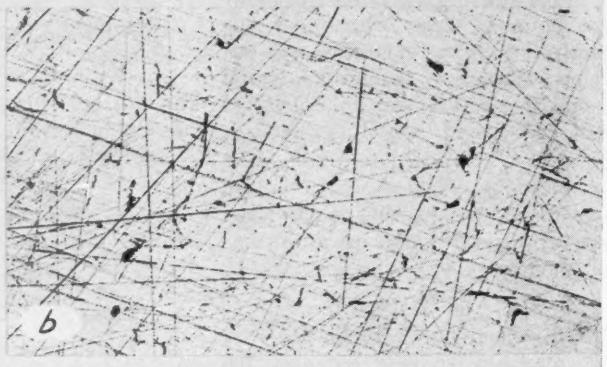


Fig. 4. Bessemer Screw Stock.





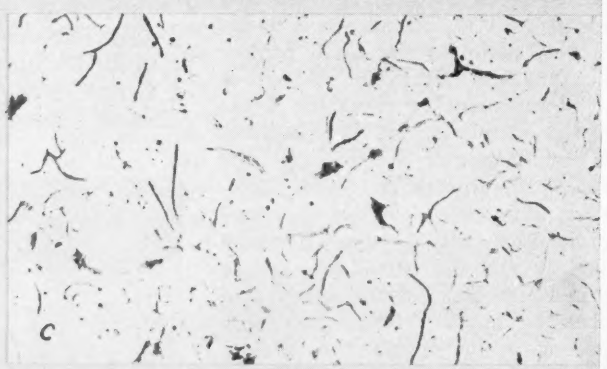


Fig. 5. Cast Iron.

(a) 1st Step, scratches produced on lead lap with 302 emery and water. X 100.

(b) 2nd Step, finished on paraffin wheel with 600 grit carborundum and soap water. X 100.

(c) 3rd Step, final polish on synthetic cloth. X 100.

(d) Same as (c) except X 500.

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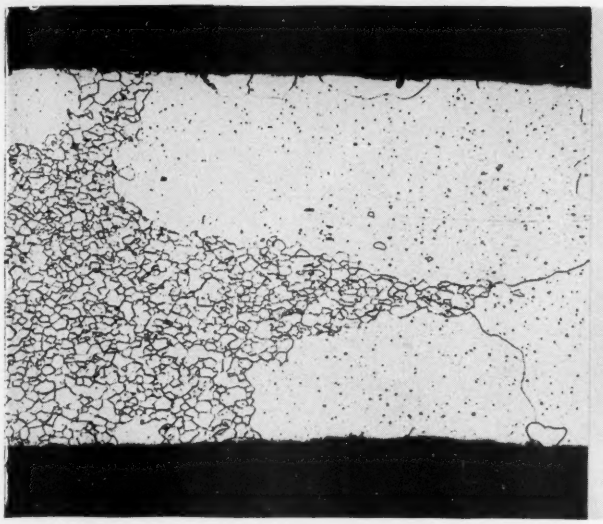

Fig. 6. Low carbon steel, mixed grain size developed by annealing a critically strained stamping. X 100. ★ ★

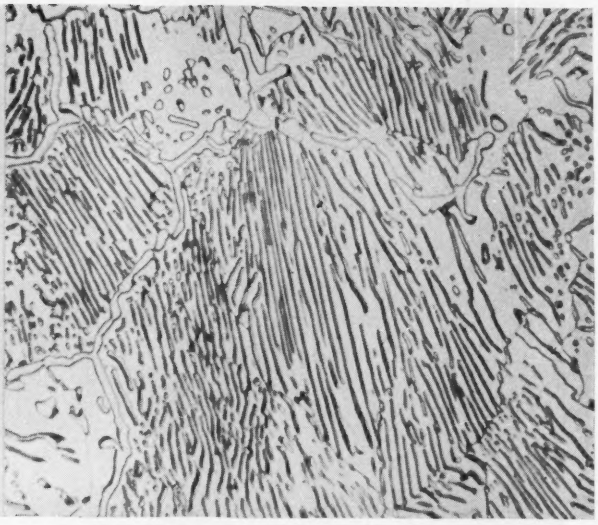

Fig. 7. 1.00% carbon tool steel, furnace cooled from 1600° F. X 1000 ★ ★ ★

evenly across the entire surface of the specimen instead of beginning at the edges and working to the center. Inclusions can be retained even by reasonably prolonged polishing. In case disturbed metal is recognized or suspected the specimen may be re-polished and re-etched repeatedly in the customary manner but numerous repetitions are normally unnecessary and relief polishing may become too severe.

★ ★ ★

WHILE much of the success of this method of polishing can be attributed to this synthetic cloth, it must be remembered that it will not repair improper polishing in the previous steps. Scratches that are too deep will only be "rounded-out" after prolonged polishing and never become leveled. Obviously any inclusions that have been "dragged-out" in previous steps will not be replaced. The operating speed for this wheel is approximately 250 R.P.M.

★ ★ ★

A GOOD abrasive for use on the synthetic cloth is **Gamal** concentrate sold by **Fisher Scientific Co.** It is white in color and therefore does not discolor the hands like magnesium oxide, rouge or C RO. It does not collect into hard lumps that are difficult to break up and disperse after long standing. It has proven highly successful when diluted with 20 parts distilled water to 1 part of the concentrate and neutralized with triethanolamine to a pH of 7.0 to 7.5.

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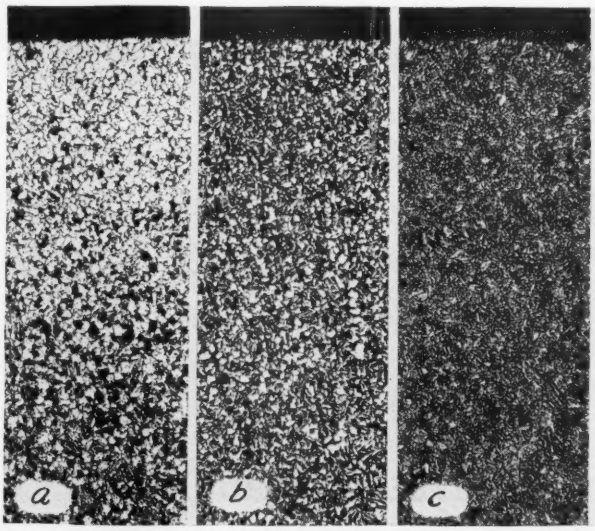

Fig. 8. N. E. 8630, Steel.
(a) Normalized 1650° F. cooled in air. Decarburization .025"
(b) From same article after carbon restoration treatment.
(c) Same as (b) except after hardening and tempering to Rockwell C 27 on surface and in core. X 100 ★ ★

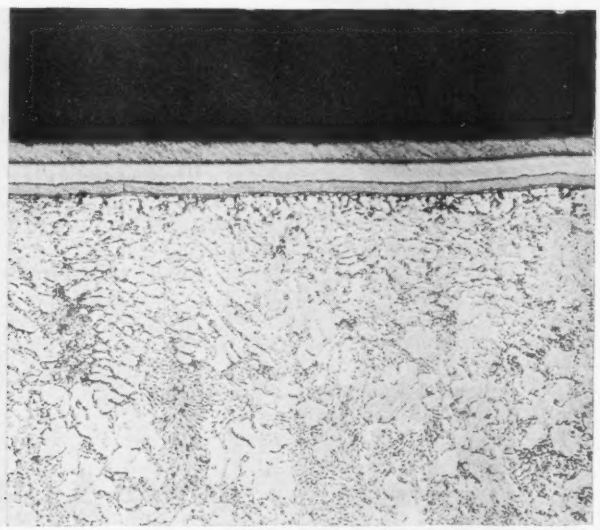

Fig. 9. Zinc Die Casting plated with copper, nickel, copper. The top layer of copper is plated on to fully protect the nickel plate edge during polishing. Prime layer of copper .00012". Nickel .00056". X 500 nital etch. ★ ★ ★

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Applications of Fiberglas to Wire and Cable

By Fred F. Sampson, Jr.
Electrical Division
Owens-Corning Fiberglas Corporation
Toledo, Ohio

A discussion of the characteristics and applications of Fiberglas to wire and cable. A paper presented before the Wire Association Annual Convention at Buffalo, New York, October 1946. ★ ★ ★ ★

THE conversion from War to Peace time production has presented many serious problems to the wire and cable industry. The copper shortage has meant changes in products, revision of production schedules and a continual effort to make the best use of the available copper without jeopardizing good customer relationship. Unsettled labor conditions, insufficient supply of fibrous covering and fluctuating prices for practically all raw materials contribute further to production difficulties.

★ ★ ★

THESE problems make it imperative that new materials be investigated for possible improvement in the finished product and/or short cuts in manufacturing. Sometimes an improved manufacturing technique is made possible by using a different type of insulating material resulting in a better product without increased finished cost. In the search for improved materials Fiberglas has proved to be a unique material which lends itself to new designs and manufacturing procedures. Even in some of the most competitive cables Fiberglas is being used today and is made practical by taking advantage of its basic characteristics.

★ ★ ★

Basic Characteristics of Fiberglas

FIBERGLAS continuous filament yarn consists of strands of very fine, flexible fibers of glass which have been combined to the desired size and given a twist to form yarn. The resulting properties are, therefore, similar to those that would be expected of solid glass, except that the fiber form gives the yarn flexibility like other textiles. The basic properties briefly are:

a) **High temperature resistance and non-combustibility — Fiberglas textile materials will not burn and they retain their strength over a wide temperature range, being stronger at 800° F than most organic textiles of the same size at room temperature. The limitation in this respect in general for electrical insulation purposes is the insulating varnish, lacquer or saturant combined with the Fiberglas.**

b) **High tensile Strength — The tensile strength of Fiberglas yarn is 2 to 4 times that of other textile yarns of the same diameter commonly used in the wire and cable industry.**

c) **Space Factor — Fiberglas yarns have excellent space factor. When they are applied as a wrap on fine size magnet wire, the build-up can be held to less than 3 mils on the diameter. Uniform coverage and low build-up provided by Fiberglas yarns are of great advantage where space is limited. Coupled with minimum build-up is the characteristic of the yarn to flatten out when applied to a wire or cable which results in relatively large coverage per pound of yarn.**

d) **Moisture Resistance — Fiberglas textiles themselves do not absorb moisture. When combined with an impregnant, the moisture resistance of the combination depends on the absorption property of the impregnant and on the quality of the impregnating operation.**

e) **Acid Resistance — Fiberglas textiles are not subject to attack by oils or most acids.**

f) **Thermal Conductivity — Fiberglas textile materials have higher thermal conductivity than most other textiles and, therefore, offer the advantage of a more rapid dissipation of heat generated in electrical devices.**

g) **Permanence — Fiberglas textiles are made of glass of particularly high stability and durability. Accelerated weathering tests and performance in commercial installations under adverse con-**

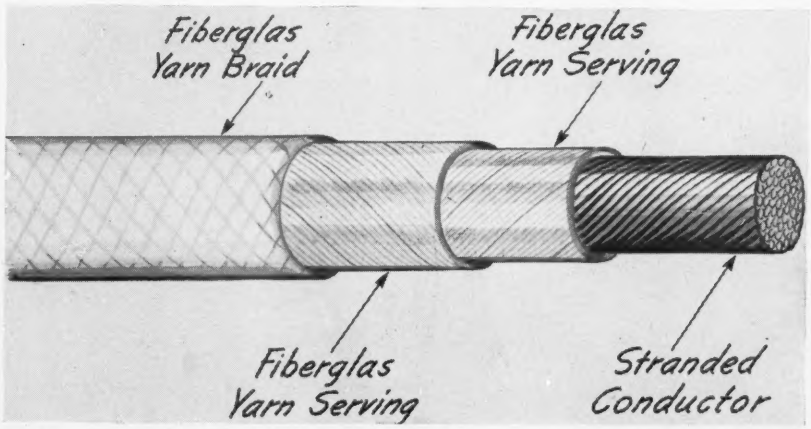


Fig. - 1A (Diagram and photo) — "High Temperature Lead Wire" Two reverse serves Fiberglas yarn with an outer bend of Fiberglas,

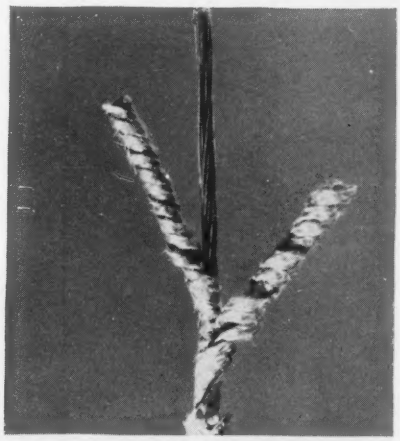


Fig. - 1B (Diagram and photo) — "High Temperature Lead Wire" — Two reverse serves Fiberglas, yarn with an outer braid of Fiberglas, silicone bonded. ★ ★ ★

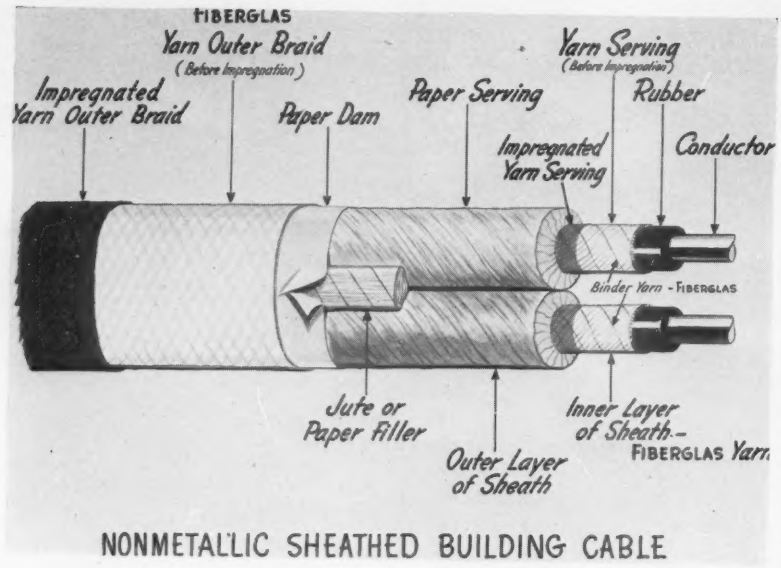


Fig. - 2A (Diagram and photo) — "Non-metallic sheathed building cable". — Fiberglas outer braid and as binder yarn over individual rubber conductors ★ ★ ★

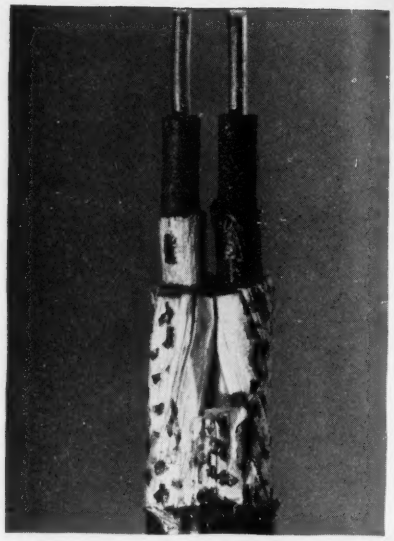


Fig - 2B (Diagram and photo) — "Non-metallic sheathed building cable". — Fiberglas outer braid and as binder yarn over individual rubber conductors. ★ ★ ★

ditions indicate comparatively unlimited stability under repeated cycles of heat, cold, condensation, and drying.

h) Dimensional Stability — Fiberglas textiles do not shrink or swell under changing humidity conditions and therefore provide a dimensionally stable textile base for impregnating materials.

i) Electrical Properties — When properly impregnated, the electrical properties of Fiberglas textiles are generaliy superior to those of other commonly used electrical textile materials.

j) Abrasion Resistance — Unimpregnated Fiberglas textiles are subject to breakdown under abrasive or flexing action because the individual glass fibers cut each other. However, properly impregnated, the fibers are supported and protected against abrasion by each other, and will withstand as much abuse as the impregnant itself will tolerate.

★ ★ ★

THESE basic characteristics are incorporated in many commercially available cables today. Fiberglas insulated magnet wire has been produced now for many years and is an established product in the electrical industry. Both wire manufacturers and users are familiar with single or double Fiberglas over bare copper, over enamel or over synthethic enamel. Fiberglas insulated lead wire, resistors, radio hook-up wire and ignition cable are also familiar commercial products.

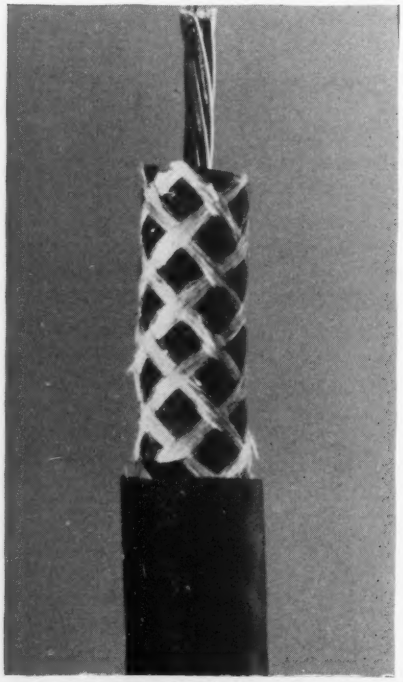


Fig. - 3. "Innerbraid Ignition Cable" — Fiberglas open braid between primary insulation and neoprene jacket. ★ ★ ★

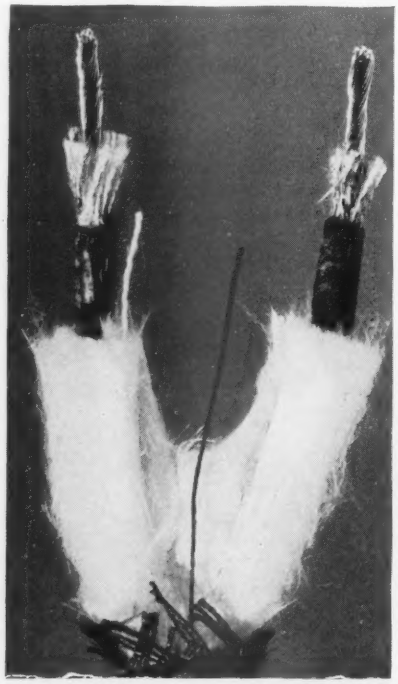


Fig. - 4. "Heater Cord" Showing Fiberglas identification marker. ★ ★ ★

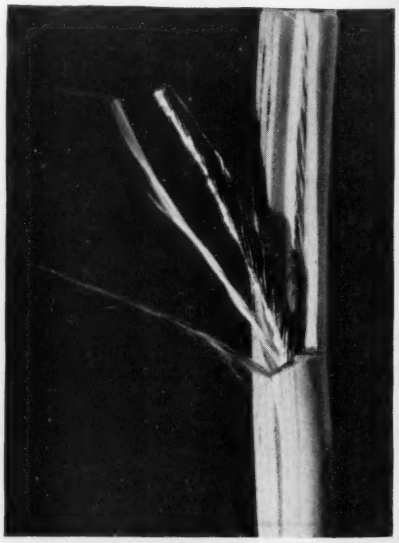


Fig. 5 "Fixture Wire" — Showing Fiberglas identification markers. ★ ★ ★

Recent Fiberglas Developments
Dyed Yarns

FIBERGLAS dyed yarns have recently been developed in the colors used by the wire and cable industry. In the manufacturing process, the glass fibers are coated with a pigmented sizing material to produce a uniformly colored yarn. The dyed yarns are furnished in various plied constructions, including plies consisting of two or more different colored strands. They are being used extensively for company marker threads in all types of wire and cable requiring manufacturer's identification. In high speed extruded synthetic resin operations the identification yarn is applied parallel to the copper wire immediately before the extrusion and a break in the yarn results in a costly stoppage of operation plus scrapping of whatever wire has passed through the operation after the yarn break occurred. Fiberglas dyed yarns have proved particularly satisfactory for this operation due to their high tensile strength and resulting decrease in breaks. The excellent space factor of Fiberglas yarns also is an advantage in applications of company marker yarns where the outside diameter of the extrusion must be kept to a minimum. The resistance to high temperatures of Fiberglas dyed yarns adds another desirable characteristic for marker thread applications. Laboratory tests simulating operating conditions in a process in which the marker yarn is applied underneath rubber covering, demonstrate that the Fiberglas yarn is practically unaffected where many organic type yarns are seriously deteriorated. Fiberglas dyed yarns are now being used extensively as binder yarns in rubber covered building wire in constructions where the binder yarn also serves the purpose of company identification.

* * *

ANOTHER field of applications for Fiberglas dyed yarns is in the tracers and full colors of the outer braid or serving of various types of wire and cable. An example is the present commercial use of the dyed yarns in the outer braid of automotive ignition cable. Development work is currently being carried out by various manufacturers in the use of Fiberglas dyed yarns as either tracers or full color combinations in the outer textile covering of radio hook-up wire, ballast wire, switchboard wire, multiple conductor cables, low tension automotive wiring, and others.

* * *

Special High Temperature Textiles

THERE are many applications where an insulation is needed to withstand operating temperatures of 1000° F or more. Thermocouple wire, range heating elements and similar resistance wire applications, soldering irons, domestic irons and induction coil spacers are typical examples of end uses for this high temperature insulation material.

* * *

TO meet this demand Fiberglas textiles are specially processed to make them heat stable up to 2000° F. In the electrical field Fiberglas special high temperature tape and sleeving have been used experimentally with considerable success and these materials can be furnished in limited quantities. It should be remembered that this material would not be satisfactory for applications where severe flexing or mechanical abuse is encountered since no impregnant is used.

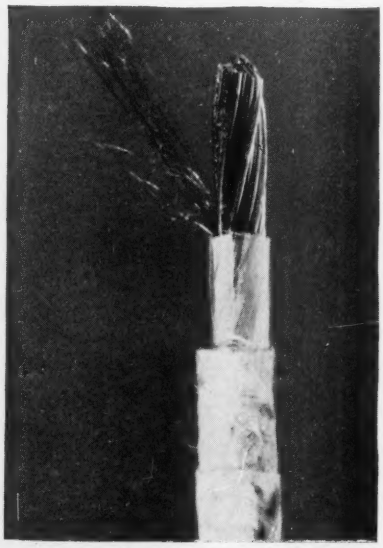


Fig. - 6. "Aircraft Low Tension Wire" — Fiberglas yarn next to conductor as identification marker; also in outer braid with colored circuit identification tracer. * *

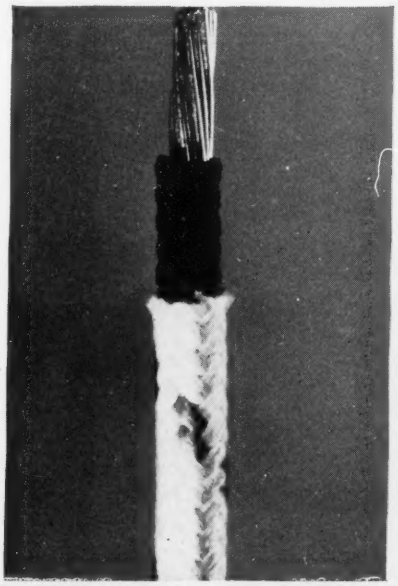


Fig. - 7. "Aircraft Low Tension or Radio Hookup Wire". — Fiberglas yarn used as a braid over primary insulation with colored circuit identification tracer. * * *

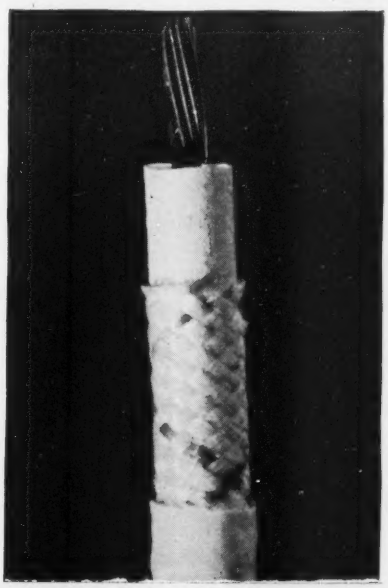


Fig. - 8. "High Temperature Lead Wire". — Silicone rubber extrusion, Fiberglas braid, outer silicone rubber coating. * * *

Fiberglas-silicone Combinations

INCREASING interest in the electrical industry in the superior properties of Fiberglas-silicone combination materials has resulted in considerable development work by wire and cable manufacturers. Silicone - varnish - impregnated, Fiberglas-covered magnet wire is being produced on a semi-commercial basis by several manufacturers. Laboratory work is being conducted on cable constructed with a silicone rubber extrusion over the conductor followed by an outer Fiberglas braid impregnated with silicone varnish. Also in the development stage is work on the application of silicone varnished Fiberglas cloth applied as cable tape wrap. The superior electrical properties, resistance to high temperatures and to moisture and the permanence of Fiberglas and silicone combinations warrant further development work on them. Ultimately commercial applications in the wire and cable industry for Fiberglas-silicone materials will be a reality.

* * *

Tension Cord

FIBERGLAS cordage is now used commercially as the tension member in cables designed for maximum flexibility. In this application the yarn offers advantages of extremely high tensile strength at minimum size, combined with permanence and non-combustibility. The cordage is being used currently for DCOP Navy cable, coaxial cables, etc. Another interesting application for Fiberglas tension cord is the use of the material as a core for electrical resistors, where the characteristics of temperature resistance and permanence are advantageous.

* * *

Superfine Fiberglas Yarn

IN the laboratory stage is development of Superfine Fiberglas yarn with fiber diameter considerable smaller than that used in present commercial Fiberglas yarns (individual filament .00006" to .00010" in diameter). This material when fully developed should have many applications in the wire and cable industry. The new textile material for one thing has slight stretch or "give" that will be advantageous in application to a wire or cable. The new yearn also will probably show improvement in readily taking up impregnants and should provide a covering with the cushioning effect generally found in other textile materials.

* * *

Fiberglas Applications to Wire and Cable Building Wires

FIBERGLAS yarns of larger fiber diameter and heavier strand size than those generally used for magnet wire covering are being used in large quantities in rubber covered wire and non-metallic sheathed building cable. The largest quantity of material currently used is Fiberglas yarn for the braided outer jacket of non-metallic sheathed building cable. In this application the Fiberglas yarn provides a textile braid which in itself is non-combustible and therefore adds to the flame resistance of the combination of braid and asphalt compound. In the same sense the yarns do not themselves absorb moisture and are not subject to attack by corrosive vapors and, therefore, contribute to these characteristics in the combination of braid and compound. The extremely high tensile strength of Fiberglas yarns adds to the tensile strength and rugged nature of the cable. Finally the inorganic yarn provides a permanent base for the asphalt compound that will not rot under the most extreme service conditions. It is interesting to note that as a result of relatively high coverage obtained with Fiberglas yarns, the technical advantages mentioned above can be obtained in the outer jacket application by a cable manufacturer at a cost equivalent to the cost of commonly used organic textile yarns.

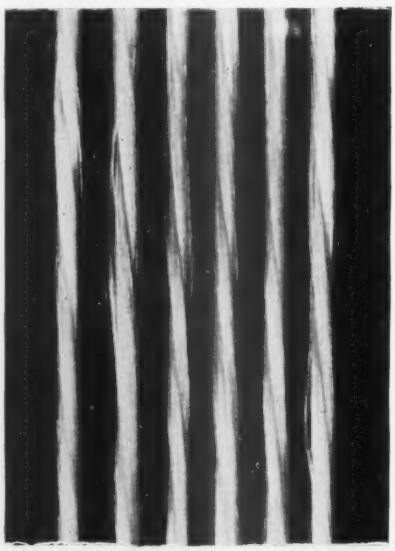


Fig. - 9. "Properties" — Enlarged photograph of Fiberglas yarn showing the low twist construction which permits maximum coverage when applied to wire and cable. * *

* * *

FIBERGLAS yarns are also being used commercially for the binder yarn of rubber covered single conductor building wire. Once again the yarns provide high tensile strength and ruggedness, permanence and resistance to flame and moisture. As mentioned previously, where the binder yarn also identifies the manufacturer, Fiberglas dyed yarn is used. The next step, to add further to the above mentioned characteristics of rubber covered wire, is to apply Fiberglas yarns as the textile wrap immediately over the rubber covering. Several manufacturers are now experimenting with this type construction.

* * *

Ignition Cable

DURING the war considerable Fiberglas yarn was used in aircraft ignition cable. A Fiberglas braid is applied over the initial extrusion of natural or synthetic rubber and an extrusion of neoprene rubber is applied over the braid for the outer coating. The Fiberglas yarn provides a strong, inorganic braid which holds the inner rubber extrusion firmly against the conductor. Design of this type, using Fiberglas inner braid, is now being used in production quantities for automotive ignition cable.

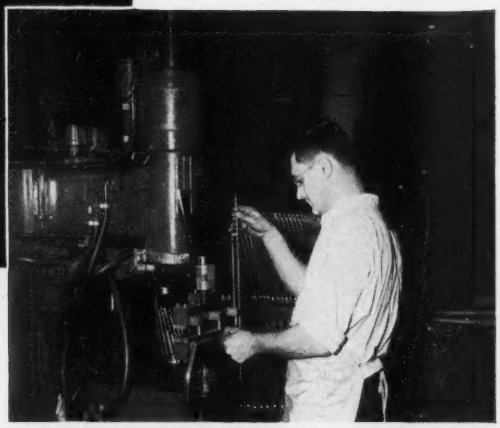
* * *

Lacquered Wire and Cable

FIBERGLAS yarns are being used in increasing amounts in braided

(*Please turn to page* 910)

1 to 18 wire welds on the same welder!

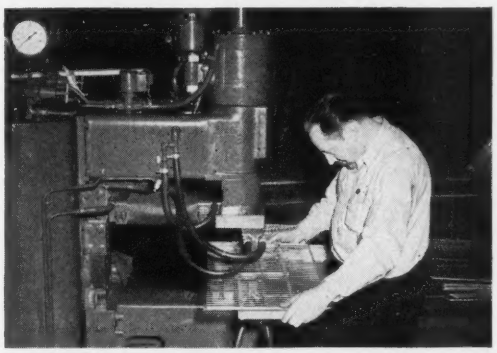


3 simultaneous spots weld .050″ channel to .225″ wire frame on these refrigerator trays.

Wire trays for refrigerators, ovens, kitchen cabinet shelves and many other uses are being produced *at the rate of 2,000 per hour* at the modern plant of the L. A. Young Spring and Wire Corp., Detroit.

A recent installation of 14 Sciaky 250 KVA projection welders helps maintain this impressive production record. An outstanding characteristic of these machines is *flexibility* . . . the same welder can accommodate many jobs with only a simple change in dies and settings.

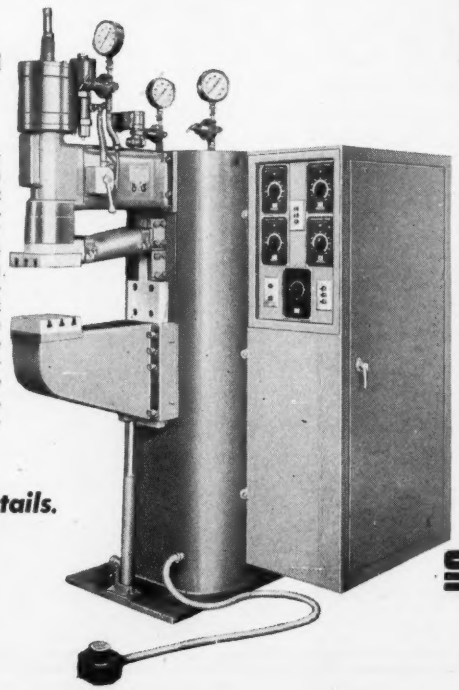
If your problem involves joining wire in one or many operations, it will pay you to investigate this rugged, versatile welder. Ask for a SCIAKY application engineer.



9 cross wires of .092″ stock are welded to an .307″ trim section in one operation.

Specially Designed for use in the Wire Industry

This projection welder (type PMCO 1-250-18) is rated 250 KVA at 50% duty cycle. Capacity is from two 1/16″ basic steel wires up to and including eighteen 11-gauge wires. Stepless heat adjustment is provided by *both* tap switch and phase shift. Complete electronic controls insure balanced circuit, cleaner, faster welds.



Handles are welded to refrigerator tray with two simultaneous spots. (Majority of material is 18-8 stainless steel.)

Write for Complete Details.

SCIAKY BROS.
Inc.
4901 WEST 67th STREET, CHICAGO 38, ILLINOIS

Wire Drawing in England

By P. Grodzinski, A.M.I. Mech. Engr.
Technical Consultant,
London, England

The author sets forth a very complete picture of copper wire drawing practice in English mills. While much of this parallels our own, details vary in some points and a comparison of these differences by our American readers may stimulate our thinking on why we do things the way we do. ★ ★ ★

THIS article is based on some information obtained from the present day methods used in English wire drawing plants and the data have not been published before. Reference is also made to some recent literature on the subject.

★ ★ ★

MODERN die drawing machines and die shapes do not eliminate the necessity for providing minimum friction and easy flow in the actual contact surfaces. Proper cleaning of the wire and the maintenance of a lubricating film which withstands the heavy pressure in the die are esential.

★ ★ ★

Cleaning

COLD diluted sulphuric acid (20 parts water to 1 part acid) is a good and economical pickling solution, being mild and stable and giving off practically no fumes. This solution pickles black rods in 2 or 3 hours, and being cold, enables the rods to be lifted from the acid to the wash without risk of the oxide drying on the copper. Tanks lined with acid resisting tiles, or built entirely of acid resisting bricks are, owing to their long life, preferable to lead-lined wooden tanks. Several small tanks are better than one large one, as the pickling acid can be pumped from one to the other, so that each tank can be cleaned or repaired without loss of solution or production. Each tank or section should have a sump in order to completely drain the bottom. (Figs. 1 and 2). Rods should not be allowed to stand on the bottom of either brick or lead-lined tanks. It is far better practice to suspend the rods from a stout wooden bar, preferably of teak, or a metal bar made from one of the many acid proof steels or bronzes in use today. The bar can either be supported at each end on a ledge built into the sides of the tank (Fig. 1), or from a second bar across the top (Fig. 2). Several rows of rods can be suspended in each tank, each bar holding from 8 to 10 rods. The bar complete with rods can be lifted when the copper is pickled, and easily conveyed to wash, and hosed while suspended from the hoisting tackle. The hoisting tackle hook should revolve freely to enable the bar and rods to spin round so that thorough and efficient washing and hosing is possible. The operating switches should be within easy reach of the pickler and preferably from an outrigger arm from the hoist, so as to clear the crates or bars when loaded with acid saturated rods or while being hosed or washed. Mechanical traversing of the hoist should always be provided for, as the total weight of bar or crate and rods, is about a ton.

★ ★ ★

EXPERIENCE with a conveyor system of rod pickling where rods were carried singly on acid

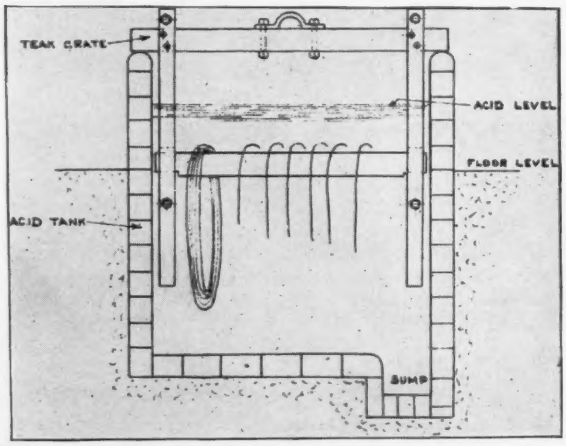


Fig. 1a. Acid tank with teak wood crate.

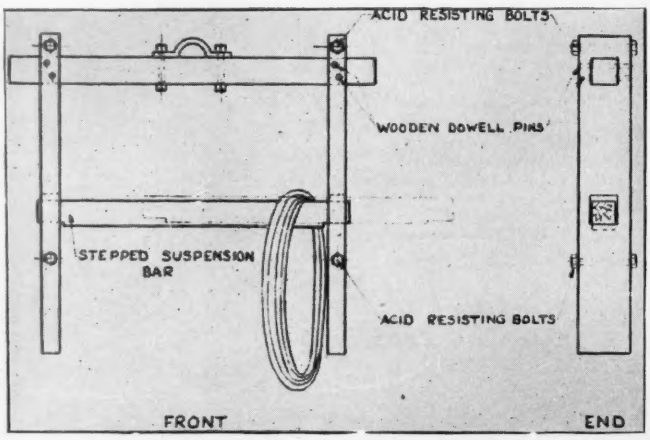


Fig. 1b. Teak crate with slide-in centre bar.

resisting hooks in tandem, and traversed three times through a large tank, and then to the wash and drawing machines, the conveyor continuing its circuit to the black rod loading point, showed that the disadvantage was the length of time taken by the pickled rods leaving the acid until reaching the wash, the oxide drying on the rods again meantime. This was partially cured by spraying the rods with fine water jets immediately after leaving the acid. Another disadvantage of conveying the washed rods straight to the drawing machines is the omission of immediate soaping or provision for washed rod storage. The old and proved method of storing washed rods in tanks containing soapy water, or one of the proprietory solutions has much to commend it. Without protection of some kind the chemically clean copper oxidizes very rapidly and the soapy solution prevents this taking place, also neutralising any oxide or acid remaining on the rods after the wash. It is further of importance that at least enough rods for a day's production on the wire-drawing machines should always be washed and in soap storage, as reserve against delay or breakdown in pickling. For this reason ample washed rods store tanks should be provided, and always fitted as near the drawing point as possible.

* * *

NO copper pickling plant is complete without copper recovery, enabling the plant to be run continuously without changing or waste of acid, or slowing down of pickling time owing to copper saturation. The constant circulation of the acid between pickling tanks and recovery tanks, via the reservoir, created by means of compressed air pump, helps considerably to quicken pickling.

* * *

A plant pickling up to 100 tons of copper rods per week should be able to recover about three tons of copper deposited on the cathodes. Occasional topping up with diluted acid to make up for loss is all that is required. The bus bars and surrounding of the recovery tanks should be kept free from corrosion and accumulated copper sulphate. A little petroleum jelly smeared on the terminals assists in checking bad contacts. A band of petroleum jelly, 3 or 4 in. wide across the copper cathodes at acid level, prevents eating away of the plate owing to the rise and fall of the acid at this point, part of the band to be slightly below acid level.

* * *

A provision often lacking is that of an extra reservoir tank fixed at a level to enable any part of the pickling or recovery tanks to be drained or pumped into it. It enables any part of the plant to be drained for cleaning or repair without loss of acid or production. Isolating valves fixed to each tank, enable any tank to be temporarily out of action. Both copper and lead plates should be examined at frequent intervals to check unequal plating on cathodes and pitting or erosion on anodes. The copper content and acid strength should be frequently tested and kept at a steady figure. If the copper content is below 20 grammes per litre the recovery should be shut off until the figure has risen, as poor quality plating results when the plant operates at too low a value.

* * *

WHATEVER methods are used in rod washing, water at **high** pressure is essential. Swilling is virtually useless as copper oxide is sticky and rough and requires a blow, more than a spray to be removed. The water must penetrate into the heart of the coil with **force.** The whole of the coils should be covered and if the suspension by crate or bar is used, particular attention should be given to the part resting on the bar and to the base of the coils as oxide has a tendency to settle there. The drainings from the wash, containing a large proportion of copper oxide, should be run gently over a succession of weirs. The wash should not be allowed to enter the top settling tank in any volume as the oxide will not be given chance to settle. A long perforated earthenware pipe laid across the entry edge of the topmost step of the weirs is a good method of controlling the outlet from the wash. Each tank of the weirs should be deep, but very little below the edge of the one above in order to allow a gentle fall from one settling tank to the other. A considerable amount of copper oxide can be obtained in this way and the final drainings are pretty free from any oxide only contain a very small proportion of acid. It is still desirable, however, in most instances to pass the final drainings through a neutralising tank, containing free lime which is renewed from time to time. When collecting the oxide from the settling tanks, the clear surface water is syphoned off so as not to stir up the mudlike layer of oxide. One way of disposing of the oxide so recovered is to place it in the reservoir tank of the recovery plant. It will then dissolve and pass through the recovery

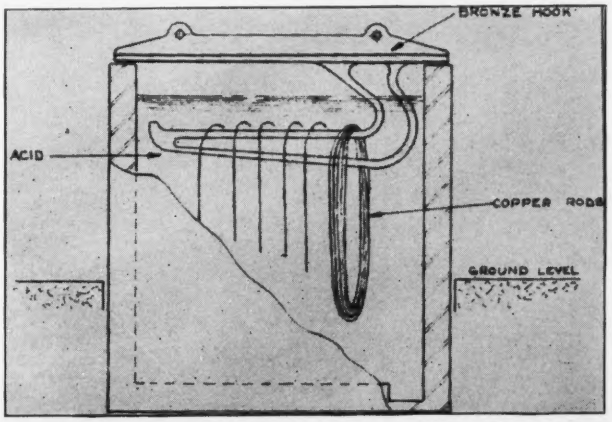


Fig. 2. Acid tank with suspension bar.

tanks being finally recovered as pure copper on the cathodes. The settling and neutralising tanks can be made of wood but acid proof tiles or bricks are far preferable. (Fig. 3).

* * *

THE ground occupied by the wash disposal plant can either be railed round or covered (Fig. 4). The stand of loading rods, for pickling by crate or bar, or unloading at wash can be bolted down or braced against the tanks.

* * *

CLEANING by pickling has been challenged by other methods. **Randall** [1] mentions a salt bath in which annealing and cleaning can be carried out in one operation. The bath is heated with gas from an external source or by employing internal electrical heating. (An interesting example of the molten salt process is the glass coating process recently developed in U. S. A.)

[1] **W. F. Randall, Wire-drawing, Metal Industry, Vol. 67, 1945, pp. 50-52, 66-69, 88-90.**

MOLTEN **caustic pickling** is being more widely adopted. The effect of the molten bath is sometimes combined with electrolytic action as in the Tainton process. The **Tainton-Hooker** process uses a special addition to the caustic bath said to leave a sludgy deposit on the wire which forms a good lubricating base, so that further cleaning is not necessary.

* * *

ELECTROLYTIC **pickling** is sometimes employed but only with higher-grade alloys.

* * *

GAS **pickling** may prove to be more convenient and economical than acid pickling. The material passes first a pre-heating and then a pickling furnace. The pickling gas is generated by the combustion of a controlled mixture of flue gas and hydrogen chloride. Oxide and other surface impurities are removed as volatile chloride which may be reclaimed from the scrubbers. The cleaning takes a fraction of the time required for acid pickling and the costs compare favourably with it. The surface is clean and well suited for lubricant adhesion.

* * *

MECHANICAL shot blasting is not applicable to soft non-ferrous materials owing to the loss of metal, but it produces a surface to which lubricant readily adheres.

Surface Treatment and Lubrication

DRAWING fluids should be clean and a fresh mixture used after a certain quantity of wire has been drawn. Tonnage records should be kept to determine the quantity drawn. According to Randall [1], soap is one of the best lubricants; hard soap lubrication gives the lowest power consumption in non-ferrous drawing. In dry drawing the lubricant is applied in powder or paste form at the die, the blocks and running wire being free from it. In wet drawing, die blocks and running wire are immersed in or

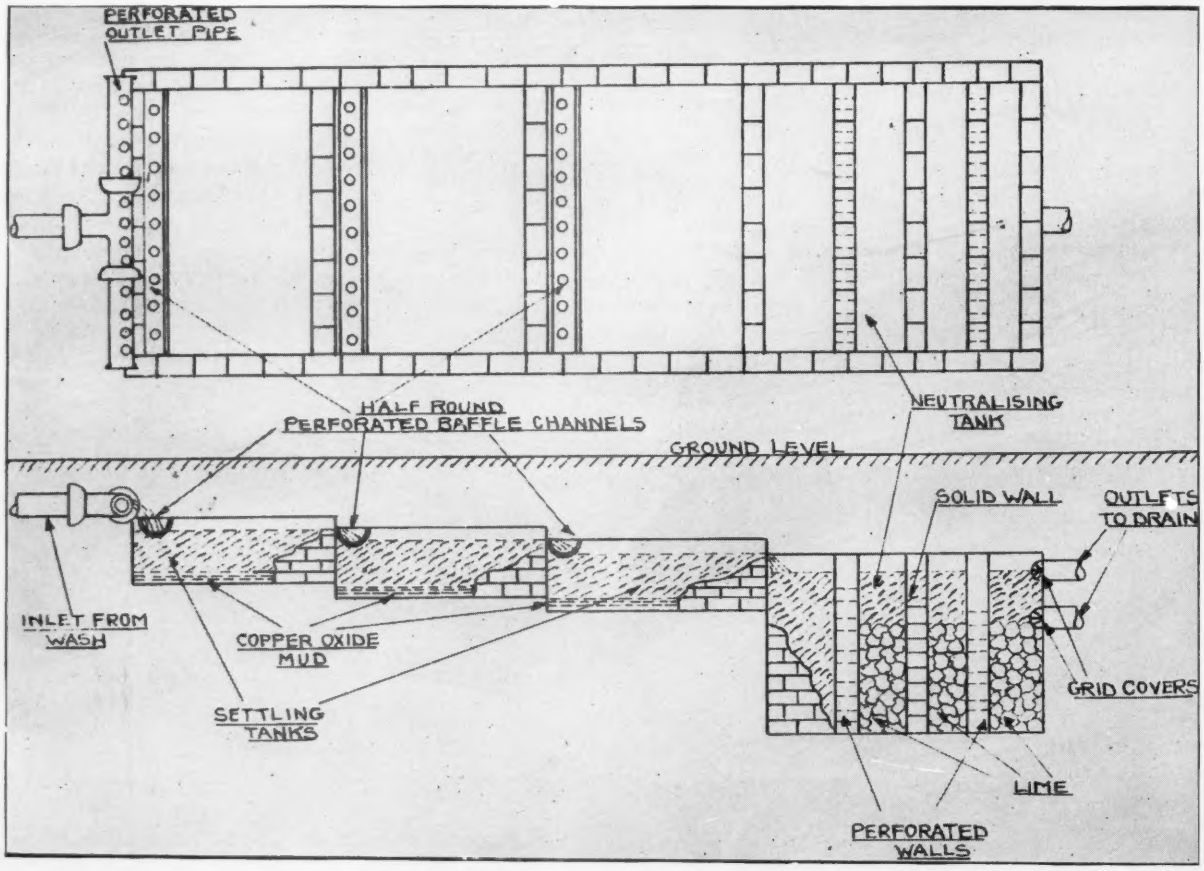


Fig. 3. Settling and neutralising tanks. * * *

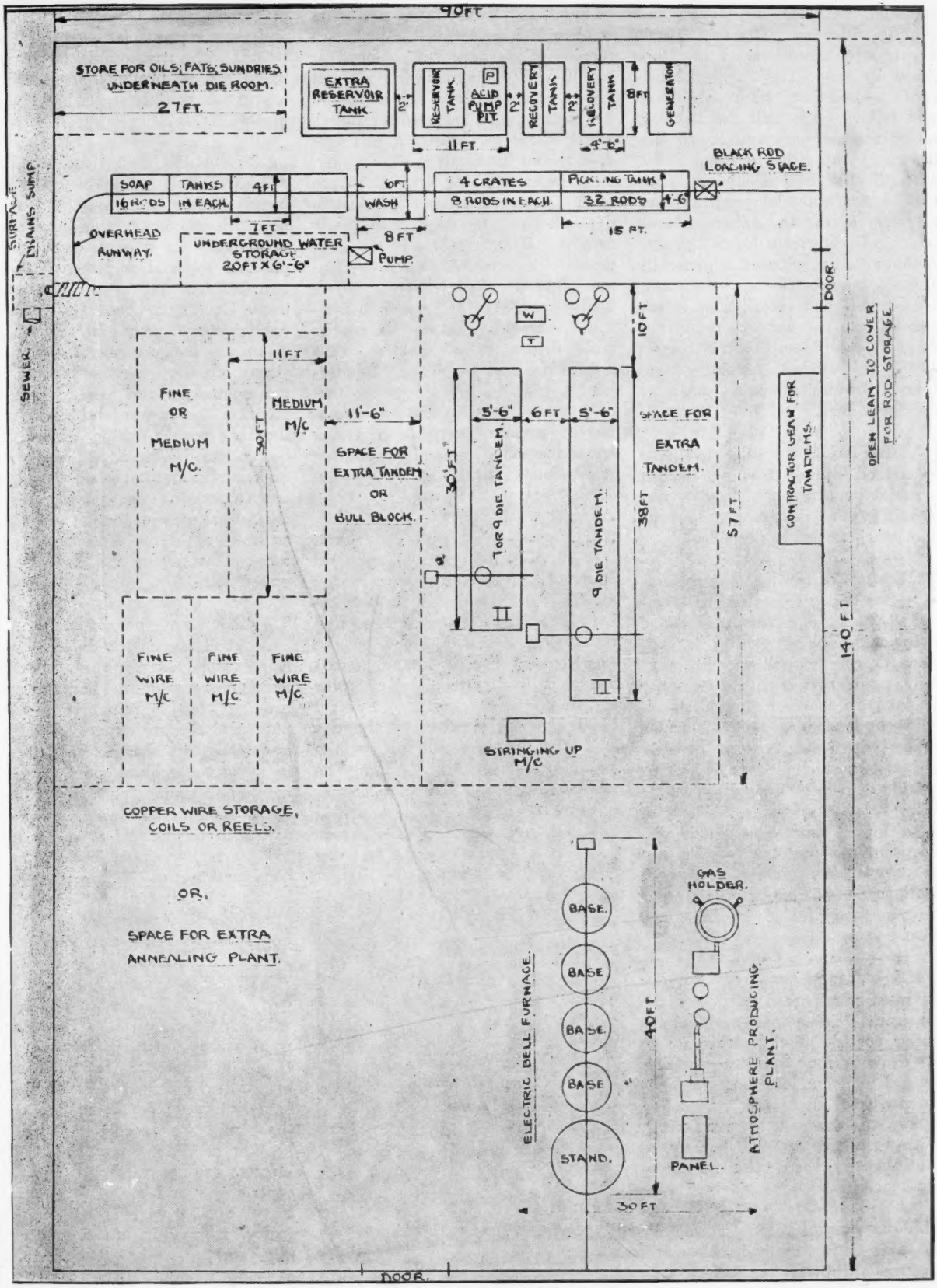


Fig. 4. Lay-out of wire shop.

cascaded with the lubricating and cooling solution. Drawing fluids are usually emulsions of oil stabilised by soap. The earliest lubricants —beeswax, olive oil, soap and tallow— are still the basis of many modern compounds. In dry drawing, soap cubes or soap flakes are still the best available lubricant, but a colloidal graphite soap mixture gives an adherent coat which will lubricate for 6-7 passes. Although soap solution is generally a basis in wet-drawing operations, soluble oils and metallic soaps are coming into use and are promising. A good soluble oil of the correct grade is suitable for all gauges from 0.056 in. diameter down to the finest size.

* * *

LUBRICANTS are also available which, during drawing, deposit a metal coating on the wire and permit greater diameter reductions than were formerly possible.

* * *

THE effect of lubricant on the finished wire must not be overlooked. Some additions may cause staining. Reducing acidity by copious doses of alkali can be overdone as it may result in copper drawing, in the formation of insoluble copper soaps which form a sludge with solid particles present, and clog and choke the die. This trouble can be overcome by a 3 to 4 in. layer of paraffin on top of the drawing fluid. The sludge dissolves in this and the paraffin can be drawn off at intervals. Special coatings are manufactured for covering the welded joints of the wire.

* * *

THE entrance angle of the dies must permit easy entrance of the lubricant. **"Cascading"** of lubricant under considerable pressure on to the drawing cones and into the dies instead of complete immersion is claimed to give greater cooling owing to the evaporative effect. With reference to the feeding of the lubricant, see section on drawing machines.

* * *

THE process of coating refractory wire with a more ductile metal to give a lubricating surface was first applied to ferrous materials. **"Cuprodine"** is used for providing steel with a copper coat. Some nonferrous alloys have such a hard or tough surface that drawing without excessive die wear is only achieved by coating with some softer metal, which holds the lubricant and acts as a heavy lubricant itself. Copper, lead, cadmium, zinc and silver are used as coatings, usually electrodeposited on the wire and finally removed if unsuitable to the purpose of the wire. A classic application of this principle is the **"Wollaston wire"** (1813) by which platinum is thickly coated with copper and drawn to a fraction of a thousandth of an inch. **"Bonderising"**, that is, phosphate coating of iron and steel is another example of surface preparation giving lower frictional loss and eliminating intermediate annealing.

Annealing

THE water seal muffle furnace, whether fired by coal, coke, oil or gas, has largely been superseded by the electric convection controlled atmosphere type. The Bell types (Fig. 5) as designed by the **Electric Furnace Company** (Efco) are said to be good lay-outs for copper wire annealing. Several cases can be operated by the one Bell Furnace and each one at the required temperature. Among its many advantages is that copper wire or steel reels can be annealed in bulk and all wire whether in coils or on reels is bright and dry and ready for use without further processing. It is clean in operation and very suitable for indoor installation. The non-oxidizing atmosphere can be provided from ordinary town coal gas, or by other means.

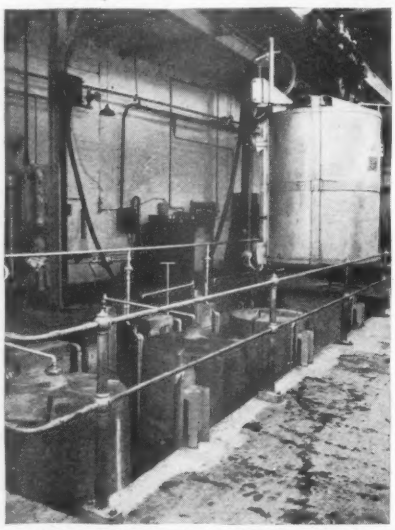


Fig 5. Bell-type electric furnaces (Efio).

* * *

ANNEALING temperature is controlled automatically by the usual electric equipment. The temperature of both furnace and bases is shown on a panel and it is possible to hold a pre-determined temperature on any particular base. Cooling is generally carried out by water spray and assisted by a fan in the bottom of the base giving greater circulation of the non-oxidizing and cooling atmosphere. The water draining from the base covers during cooling can be collected in an underground tank and is suitable for washing copper rods at the pickling plant. Other methods of cooling are used, such as air blast on outside surface of container and by interior water circulating pipes.

* * *

WIRE may be dealt with in coil or in strand. The latter is necessarily a continuous process and gives a more homogeneous product but it requires a large plant and is more expensive. Bright annealing can also be carried out in a salt or molten glass bath, as mentioned under "cleaning". There have been considerable developments in the annealing in controlled atmospheres, particularly by a combination of electric and gas heating. Treatment of brass in an atmosphere of methanol and purified flue gas is an example.

* * *

OPEN-flame annealing is a recent development. The wire which passes through the flame from a range of burners from 1 to 10 yd. in length is held in position by guides ensuring that it passes exactly through a particular part of the flame to receive the correct heating conditions and finish. The burners are accurately machined to control gas and air. The speed of travel of the wire is an essential factor. It may be up to 1500 ft./min. and might be fitted into the drawing train.

* * *

DIRECT heating by electric current has been used recently. It is a continuous process by means of rubbing or rolling contacts and has many advantages, namely temperature control through voltage, rapid heating, uniform heating throughout cross-section whatever the wire gauge, no limit to speed of travel and small heating loss (claimed efficiency up to 90%).

Drawing Machines and Their Operation

IN copper wire drawing for electric cables, the bulk of the wire rods will be of ¼ in. diameter. At least two tandem wire drawing machines will be necessary for a weekly output of 100 to 120 tons. One 9-die and one 7-die or alternately two 9-die machines of modern type produce this total, when the wire is drawn on spools holding 500, 800 or 1,000 lbs. The latest types of tandem are fitted with facilities for drawing in coils or on spools.

* * *

WHILE it is necessary to stop the machine for each coil of about 120 lbs., it is only necessary to stop for each 500, 800 or 1,000 lb. spool.

* * *

IT is good practice to keep sets of dies to various finishing sizes ready strung up for use on the tandem machines leaving a sufficient length of rod to enable welding to take place while the machine operator is stringing up. This method saves production time when changing drawing sizes or sets of dies. The pickled wire rods are run off the floor two rods being laid side by side so that the bottom end of one can be butt welded to the top end of the other (Fig. 6a). The welding takes place while the wire drawing machine is still running, by means of special welding machines or equipment. The rod guide stand, consisting of hollow pedestal and steel arm, with either fork or roller on the extreme end, is bolted securely to the ground. The steel arm is held in position over the running rod by means of a friction band around a pulley on the shaft at the top of the pedestal.

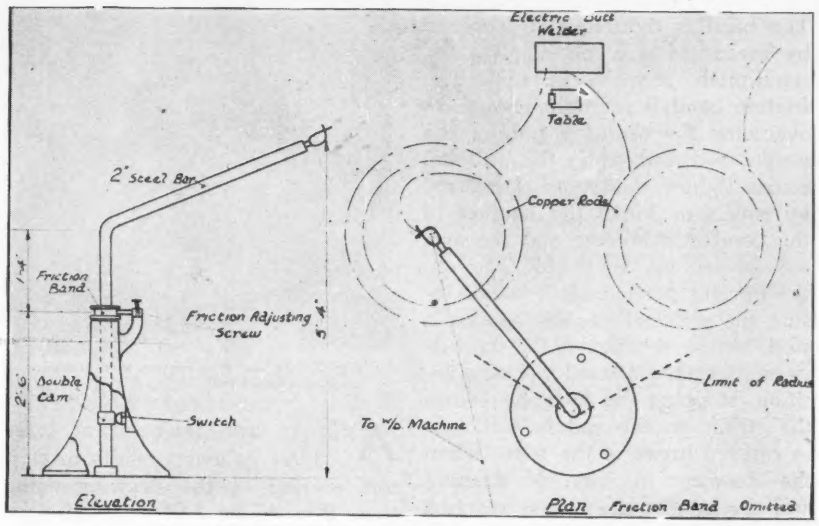


Fig. 6a. Red guide stand; lay-out

* * *

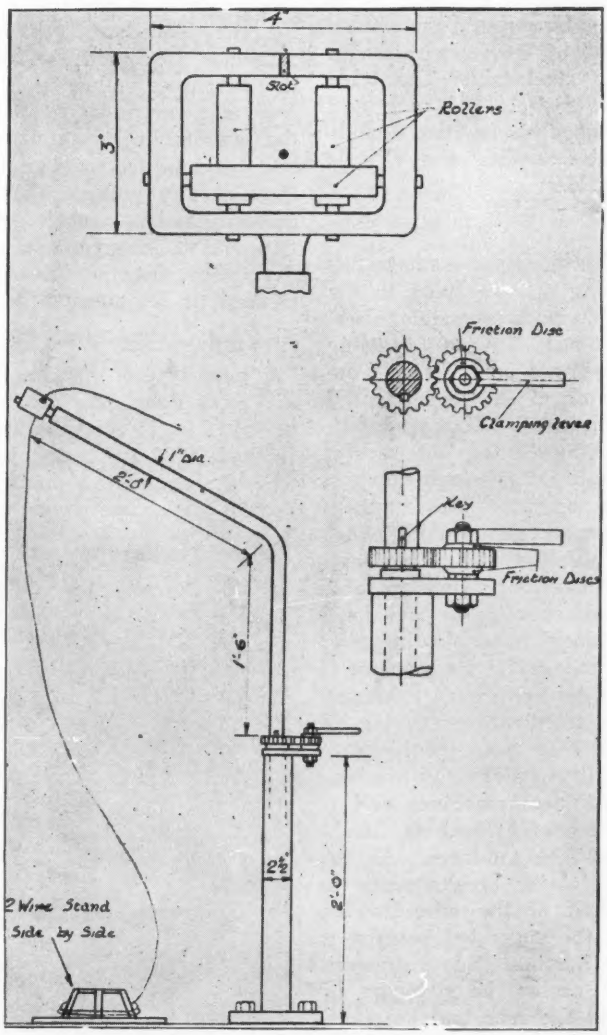


Fig. 6b. Rod guide stand.

* * *

The band is tightened or loosened by means of a crank handle, and rapid-pitch screw (Fig. 6b). The friction band is set tight enough to overcome the ordinary pull of the copper rod, but when the pull becomes tighter than normal, caused by ravels or kinks the friction of the band is overcome and the arm swings around. A double cam on the upright portion of the shaft inside the pedestal presses against a stop button whenever the arm is swung past the normal working position, stopping the machine before the strain on the rod is sufficient to cause a break of the wire. When the drawing machine is running and the end of the rod is reached the welding operator swings the arm over the other coil and as the two ends have previously been welded continuous running is achieved. The burr round the welded ends is filed off in a separate vice fixed on a steel table. The table covers the switch and plug and socket connections for the flexible trailing cable feeding the electric portable welder.

* * *

STOP buttons for emergency switching off are fixed to the table in the most accessible place. Modern tandem wire drawing machines are driven direct from the motor or via a 2 or 3 speed gear-box, controlled by push-buttons. Inching buttons at several points simplify the stringing up process. The operator presses them with his knee leaving both hands free to handle the wire. When wire is drawn in coils, a tying up table is provided, opposite to and level with the block to enable the tying up of the coils while the machine is running. An overhead runway permits convenient conveying of spider and wire from the block to the table. One stringing up machine serves 2 tandem machines and is best placed at the block or finishing end of the tandems. As the majority of wire breaks occur in the top half of the wire-drawing machines, the suggested position is much the handiest. Some drawers, however, prefer the stringing up machine at the rear end.

* * *

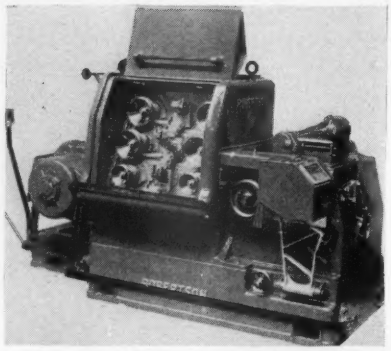


Fig. 7. 21 die type copper wire drawing machine (Robertson). * * *

A large iron tank of at least 1,000 gallons permits mixing and storing of the drawing solution. If a tallow and soap mixture is used the tank is fitted with a heating coil. If one of the proprietory mixtures is used a separate storage tank is preferable to mixing the solution directly in the machines. The tank is fixed over the machines, allowing a gravity feed and saving floor space. It is the practice in some mills to circulate the mixture through tank and machines by pump. This method certainly assists in cooling the solution, but is inconvenient whenever the wire drawing machines are cleaned or the solution replaced.

Medium Size Wire Drawing

A good type of machine for drawing down wire from 0.128 in. or 0.103 in. to sizes between 0.052 in. and 0.029 in. is the **Robertson.** The design of this machine is a radical departure from the usual stepped cone type as all the drawing wheels are of equal diameter thus preventing undue bending of the wire at the heaviest gauge. The machine is capable of drawing coils on interchangeable blocks of 8-10 or 12 in. or on spools, and speeds up to 4,000 ft./min. can be attained; 11 or 13 die machines are manufactured. When medium sizes of wire are drawn in coils, it is good practice to suit the coil diameter to the gauge, for instance, 0.029 in. gauge — 10 in. dia., 0.036 in. gauge —12 in. dia., 0.052 in. — 0.056 in. gauge, 14 or 16 in. dia. A 26% elongation should be used on this type of machine and for the indicated wire gauges. A Robertson 21 die type copper drawing machine is shown in Fig. 7, capacity from 0.0649 to 0.0048 in. Drawing speed 8,000 ft./min.

Fig. 8 — 16 die super fine wire drawing machine (Robertson) * * *

Fine Wire Drawing

GAUGES from 0.018 in. to 0.0076 in. are best drawn on a 21 die machine using block or spool. Employing draft of 23% elongation 0.0076 in. can be drawn from 0.064 in. and gauges of 0.018 in. to 0.010 in. from 0.072 in. saving a great deal of intermediate drawing and annealing. Steel spools holding 8, 20 or 60 lbs. are standard with the latest types of fine wire drawing machines. The drawing speed is between 5,000 and 8,000 ft./min. according to gauge. Automatic stops, when a pre-determined quantity of wire is on the spool or the incoming wire ravelled or broken, allow one operator to attend to two or more machines. If the wire drawn is from annealed coils two should be welded together while the machine is running, following the same practice as with the tandem or medium machines. The guide arm and pedestal is, of course, of much lighter construction. All modern machines are dynamically balanced and run on ball bearings to avoid vibration which is detrimental to die wear.

* * *

MODERN wire-drawing machines are fitted with easily replaceable drawing bands, moderate in cost and of a long life. The smaller cone type machines are provided with an oscillating movement of

(*Please turn to page* 905)

GOVERNMENT WIRE PRODUCTION INFORMATION

Disposition of German Owned Patents

AN accord was reached in London recently by representatives of 12 nations who met to discuss the disposition of patents formerly owned by Germans. Represented at the conference were Australia, Belgium, Canada, Czechoslovakia, Denmark, France, Luxembourg, The Netherlands, Norway, the Union of South Africa, the United Kingdom and the United States of America.

* * *

THE accord is open to members of the United Nations and any neutral country. The United States, the United Kingdom, France and The Netherlands have signed it. The delegates from Australia, Canada, Czechoslovakia and the Union of South Africa will recommend that their governments sign.

* * *

INTERNATIONAL trade is expected to benefit from the accord.

* * *

FOR example, an American firm producing a product in the United States under a former German patent could be prevented from exporting the product to France by the owner of the corresponding German patent in France. The American, under the terms of this accord, can now obtain a royalty-free license to export products from the French government which has seized all German patents in France.

* * *

THE patents that the various governments have seized from former German owners are available on a royalty-free, non-exclusive basis to citizens of all countries that have signed the accord.

Beryllium Production Processes

BERYLLIUM production processes used by the Deutsche Gold and Silber Scheide Anstalt at Frankfort, Germany, are described in a report now on sale by the Office of Technical Services, Department of Commerce. Before operations were halted at the end of the war, the plant had achieved a maximum monthly production of 160-180 kilograms of pure beryllium.

* * *

THE report was prepared by W. B. C. Perrycoste for the British Intelligence Objectives Sub-Committee.

* * *

THE manufacturing process was divided into two parts: production of pure anhydrous beryllium chloride from the mineral beryl, and electrolytic production of metallic beryllium.

* * *

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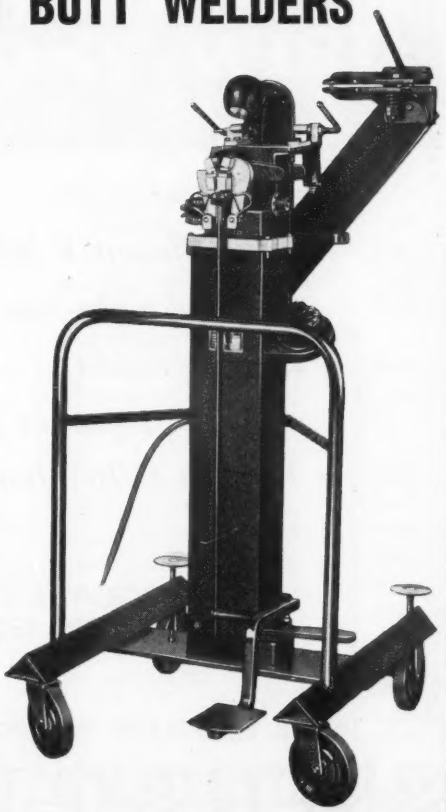
MODELS J-3-C and J-4-C AUTOMATIC MICRO-WELD BUTT WELDERS

These welders are used for welding COPPER, ALUMINUM, and other non-ferrous wire ranging in size from .031" to .128" diameter.

The welding cycle on these welders is automatically controlled and completed by a single downward stroke of the foot pedal, which include the clamping of the wire being welded, contacting the welding switch, and applying the upset pressure on the weld. All units are equipped with annealing dies, filing vise, light, extension cord, and mounted on a 4-wheel truck.



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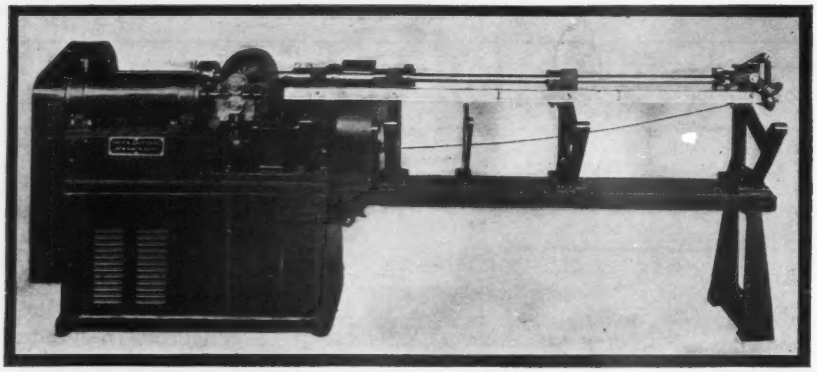

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IN the first part of the process, beryl ore was ground in a dry ball mill, mixed with lime in a drum, and then fused in a rotary kiln. To separate the silica and lime from the other oxides present, the slag was disintegrated by a water quench and then dried. The dry clinker was treated with sulphuric dioxide to form sulphates of the soluble oxides.

* * *

SILICA and calcium sulphate were removed by filtration. A hot ammonium sulphate solution was then added to the hot filtrate, and the alum in the mixture was crystallized out. Iron salts were removed from the solution by adjusting the acidity and by the addition of hydrogen peroxide and calcium carbonate. A sludge of ferric hydroxide and calcium sulphate was precipitated and removed by filtration.

* * *

THE resulting solution was pumped into a circular-stirred vessel, and ammonia gas was passed into the solution until all the sulphate was neutralized and beryllium hydroxide was precipitated. The precipitated beryllium hydroxide was filtered, dried, briquetted with organic binder and charcoal, extruded in the form of rods, carbonized, and then chlorinated. Purification of the resulting crude beryllium chloride by distillation followed.

* * *

THE electrolysis process was carried out in nickel crucibles with external auxiliary heating. The melt consisted of a mixture of equal parts of beryllium chloride and sodium chloride. The metal content of beryllium obtained from the electrolysis process generally ranged between 98 and 99 percent, according to the Germans.

* * *

BOTH processes are described in detail including flow sheets.

* * *

ORDERS for the report (PB-25668; photostat, $1; microfilm, $1; 12 pages) should be addressed to the Office of Technical Services, Department of Commerce, Washington 25, D. C., and should be accompanied by check or money order, payable to the Treasurer of the United States.

* * *

Nitrogen Content of Basic Bessemer Steel

GERMAN methods for reducing the nitrogen content of basic Bessemer steel are described in a report now on sale by the Office of Technical Services, Department of Commerce. In addition to iron and steel production methods, the report describes processes used for making ring springs, gun tubes, and other finished steel products and discusses the German steel industry's raw material supply.

* * *

THE report, prepared by Dr. Charles F. Park, Jr., and other members of a Joint Intelligence Objectives Agency group, surveys eight German iron and steel works, as well as four limestone and non-ferrous metal mines.

* * *

THE high nitrogen content of basic Bessemer steel, which makes it unsuitable for many uses, can best be reduced by maintaining low temperatures in the converter and by reducing the duration of the blow, according to metallurgists at the August-Thyssen Huette in Hamborn. At that plant, cold steel scrap was added after 70 to 80 percent of the blow, and the air blasts were enriched with oxygen to speed the conversion of iron into steel.

* * *

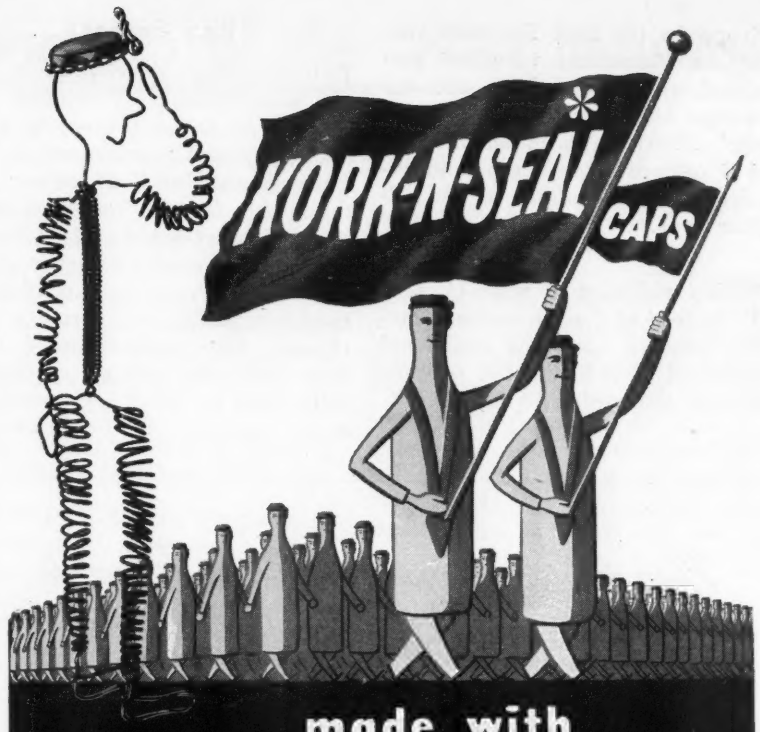
EFFORTS were made to reduce the nitrogen content of the iron and coke used in steel making. Additions of aluminum, titanium, silicon, and zirconium also were considered as a means of removing nitrogen from the steel by flux of the nitrides during the blow.

* * *

OXYGEN-ENRICHMENT of the air blast was planned by the Krupp works at Rheinhausen, but the equipment was never installed, apparently because of wartime shortages of materials. Krupp officials believed that 25 percent oxygen content in the blow would increase steel production appreciably and reduce coke consumption in the blast furnaces.

* * *

SIMILAR installations, to bring the oxygen content of the blast up to 30 per cent, were planned, by



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Krupp for the basic Bessemer converters. According to plant personnel, this would have cut the average blow from 20- to 15- minutes' duration, permitted the use of 6 percent more scrap, and resulted in lower phosphorus and sulphur content.

* * *

THE installation of wide blowers, instead of the conventional bottom blowers, also was considered beneficial in reducing the nitrogen content of basic Bessemer steel.

* * *

Ring Springs

RING springs developed by the Waggonfabrik Verdingen at Krefeld-Verdingen for use in railroad equipment were claimed by the Germans to absorb 67 percent of the load in friction. The rings were made of short lengths of flattened, pierced, unalloyed 0.6 carbon steel. These rings were then expanded on machines similar to tire rolling machinery. One machine could produce 1,400 ring springs per 8-hour shift. After an initial heat treatment in an automatic gas-fired furnace, followed by oil quenching, the finished springs were carried on a chain elevator through a vertical tempering furnace.

* * *

Enemy Patents

THE Alien Property Custodian recently announced the availability of five patents seized from enemy nationals on machinery for producing narrow fabric types which are used, for example, in the insulation of certain types of electric wires.

* * *

A list of the five patents—one of which has expired and, therefore, is usable without a license—together with information on how to secure a license may be obtained by writing the Patent Use and Development Section, Office of Alien Property Custodian, Washington 25, D. C.

* * *

LICENSES are available on a royalty-free, non-exclusive basis for the remaining life of the patents, the Custodian explained. An administrative fee of $15 is charged for each patent licensed.

* * *

ABSTRACTS of these five patents and 43 other seized patents in the fields of textiles, braiding, netting and lace making may be obtained by sending ten cents to the above address.

* * *

THE five machinery patents were issued to Guido-Horn of Berlin-Weissensee, Germany. In a report (No. PB 17549) on the machine issued by the Office of Technical Services, Department of Commerce, it is stated that the machine is of importance because of its high rate of production and its relatively low maintenance cost.

* * *

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1946 WIRE BUYERS GUIDE

Outstanding Personalities of the Wire Industry

G. W. Putnam, Central District Manager of Republic Steel Corporation

APPOINTMENT of **George W. Putnam,** assistant district manager of the Central District of **Republic Steel Corporation** as district manager was announced by **E. M. Richards,** vice president.

* * *

MR. Putnam succeeds C. W. Meyers who has resigned to become president of the Colorado Fuel & Iron Corp. Mr. Meyers has been with Republic since 1931.

* * *

WALTER M. Farnsworth, divisional superintendent, and **E. R. Johnson,** district chief metallurgist, were named assistant district managers.

* * *

MR. Putnam served with Wheeling Steel and the American Rolling Mill Company before joining Republic as open hearth superintendent of the Youngstown District in 1933. In 1937 he was made assistant district manager of the Warren District and two years later assistant district manager of the Central District.

General Electric Co. to Expand Facilities in Northern California

GENERAL Electric Company expansion plans in Northern California included greatly enlarged facilities in the Bay area and a new $1,700,000 plant in San Jose, according to company officials.

* * *

G.E. will manufacture Flamenol insulated wire and cable for industry, as well as Formex magnet wire in their Oakland plant. Integration of the company's total West Coast apparatus manufacture will be centered in the Bay area when the Oakland cable plant and the projected San Jose plant are completed.

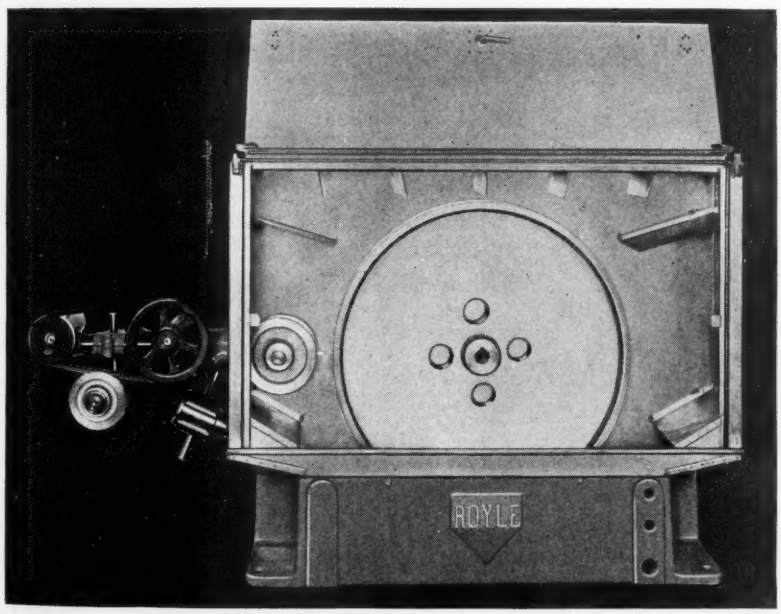
* * *

PLANS have been confirmed for the San Jose plant which will employ 2,000 persons when completed. The new structures will be built on a 57-acre site acquired in 1944 but the date for starting construction has not been revealed.

Capitol Steel Corporation

CAPITOL Steel Corporation of N. Y. removed its N. Y. executive offices to 15 Park Row, New York 7, N. Y. The new telephone number is COrtland 7-5982.

* * *



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P. F. Bronckhurst with Hydropress, Inc.

HYDROPRESS, Inc., builders of Hydraulic Presses and Rolling Mills have opened their offices at 1065 Gas & Electric Building, Denver, Colorado. **P. F. Bronckhurst** the well-known Consulting Engineer on Machine Tools and Hydraulic Equipment is in charge of the above office.

* * *

J. C. Leonard

ANNOUNCEMENT is made by **Oakite Products, Inc.**, New York, of the appointment of **J. C. Leonard** as Sales Manager of its Industrial Marketing Division. Associated with the Oakite organization in the servicing of its specialized cleaning materials and equipment for over 22 years, the last 16 years of which was in the capacity of Manager of the Company's Chicago Division, Mr. Leonard assumed his new duties on September 1, 1946. He will direct the marketing and servicing activities of Oakite's industrial field staff from the general offices of the company in New York.

J. C. Leonard, Sales Manager Industrial Marketing Division, Oakite Products, Inc.

* * *

Ajax Electric Adds Metallurgist

QUENTIN D. **Mehrkam**, formerly employed as production metallurgist by Thompson Products Co. of Cleveland, has recently joined the metallurgical staff of the **Ajax Electric Company, Inc.**, Philadelphia manufacturer of electric salt bath furnaces. He will be engaged in developing new processes and experimentally heat treating manufacturers' specimen work in the Company's research laboratory.

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25 years experience making spools and reels for the wire industry

Carl W. Meyers, President of Colorado Fuel & Iron Corporation

CARL W. Meyers has been elected president of the **Colorado Fuel & Iron Corporation**, according to an announcement made here by **Charles Allen, Jr.**, chairman.

* * *

MR. Meyers succeeds **E. Perry Holder**, who resigned, but who will remain a member of the board and of the executive committee, Mr. Allen said.

* * *

A native of Youngstown, Mr. Meyers has been identified with the steel industry for 39 years. He started as a roll hand in the bar mills of the Carnegie Steel Corporation in Youngstown in 1907 and became superintendent of the Carnegie-Illinois McDonald plant in 1923.

* * *

IN 1931 he joined the Republic Steel Corporation. He served on the War Production Board in 1943-44 and was a leader of the steel group of the United States strategic bombing survey in March, 1945.

Wickwire Spencer Moves Offices to Buffalo

WICKWIRE Spencer Steel, Division of the Colorado Fuel and Iron Corporation has moved its General Sales Manager's office from 500 Fifth Ave., New York 18, N. Y. to 361 Delaware Ave., Buffalo 2, New York. This move brought the top sales and producduction department officials into one location where it will be possible to better coordinate and bring about maximum efficiency in their service to the trade.

* * *

INVOLVED in the move were **A. G. Bussmann**, Vice President in Charge of Sales and **H. C. Allington**, Assistant General Sales Manager. The Wire Department General Office under **C. G. Matthews** also moved to Buffalo as did the Market Research Department under Henry Davis.

* * *

THE Advertising Department under **S. E. McCrum** will be located at 361 Delaware Avenue, Buffalo 2, N. Y.

* * *

THE Wire Rope Department under **A. S. Rairden** was moved to the plant at Palmer, Massachusetts.

* * *

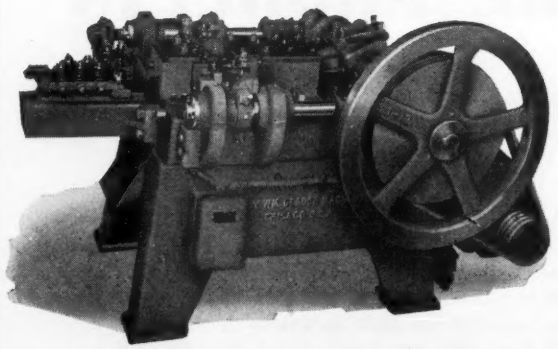
MR. **Bussmann**, Vice President, in giving this announcement of a change also announced the appointment of **Percy Jenkins** as Eastern District Sales Manager with offices at 500 Fifth Ave., New York 18, N. Y. Mr. Jenkins will continue his duties as Sales Manager of Hardware Products.

* * *

THE New York City Sales Office will hereafter be known as the Eastern District Sales Office.

* * *

GLADER HIGH SPEED WIRE NAIL MACHINE



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A Review of Recent Wire Patents

No. 2,407,160, SELF LOCKING BOLT, patented September 3, 1946 by David A. Kahn, Columbus, Ohio.

Spaced inwardly from the free end of the bolt shank is a screw threaded, slightly enlarged portion with a slot extending from this end to and through the enlargement. Resilient plastic material fills the slot and enlarged portion of the shank.

* * *

No. 2,407,337, WIRE ENAMELING DIE, patented September 10, 1946 by Robert M. Kolter, Decatur, Ind.

About the cylindrical body of the die is an annular flange, having a deep groove. The body has a non-circular opening axially through its upper portion, a conically shaped opening increasingly tapered from the non-circular opening to the bottom end of the die and is axially divided to provide a pair of complementary sections, with a resilient member fitted in the groove to encircle the body and releasably hold the sections in assembled relation. A pair of channel shaped holder members, disposed to receive the body flange therein.

* * *

No. 2,407,354. MACHINE FOR COVERING WIRES WITH INSULATING MATERIALS, patented September 10, 1946 by George Hall Walton, Helsby, near Warrington, Joshua Creer Quayle, Helsby and Peter Jones, Kelsall, near Chester, England, assignors to British Insulated Cables Limited, Prescot, England, a British company.

This machine is provided for heating pairs of strips of organic resin insulation by dielectric loss as they enter the nip of a pair of cooperating electrically conducting rolls.

* * *

No. 2,407,741, SCREW-THREADED MEMBER, patented September 17, 1946 by William Thomas Goodby, Bristol, England, assignor to The Bristol Aeroplane Company, Limited, Bristol, England, a British company.

The shank includes a threaded portion, a plain portion adjoining it, a locating collar above the plain portion and an attaching portion above the collar, the diameter of the plain portion being approximately equal to the effective diameter of the threads of the shank portion. An anchorage portion for the shank is also provided.

* * *

No. 2,407,899, WIRE REELING MECHANISM, patented September 17, 1946, by Norman H. Nye, Cuyahoga Falls, and Walter E. Rogers, Stow, Ohio, assignors to The Vaughn Machinery Company, Cuyahoga Falls, Ohio, a corporation of Ohio.

Adjustment means for the variable speed drive of a wire reel is provided including a fluid-containing cylinder, a piston reciprocable in the cylinder and operatively connected with the drive, means other than the fluid associated with the piston and tending to move same to reduce the speed of the drive, a check valve preventing escape of fluid from this cylinder in front of the piston whereby such movement of the latter is restrained, means engaging the material as it passes to the reel and adapted to be actuated thereby to unseat the check valve, and a by-pass permitting flow of fluid from the rear to the front of this piston.

* * *

No. 2,408,092. WIRE-WOUND RESISTANCE AND METHOD OF MAKING SAME, patented September 24, 1946 by Everett M. Patterson, Waterbury, Conn., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York.

A card-type support has opposite faces of thermoplastic material, with ridges along edges thereof and a pattern of grooves in the faces, extending to the ridges. Associated with the wire which is wound on the support is a thread located between the ridges, extending along an edge of the support, and being indented

(*Please turn to page* 919)

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Frederick M. Crapo, President
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Wire Drawing in England

(*Continued from page* 896)

the die housing allowing the wire to be traversed over the cone surface, and thus avoiding wear in one spot. The cones are manufactured in sections. Worn or grooved sections are easily replaced, saving ing maintenance over the rigid type; it is now possible to set the die so that the wire at entrance and exit is parallel with the bore and at right angles to the die axis. The die should also be adjustable in every plane for the same reason.

* * *

IT is bad practice to turn down drawing bands or cones when grooved, since apart from altering diameters and upsetting the drafting, the wire from cone to die and die to cone is not axially correct, excessive wear being thrown on to the bottom of the die bore causing eventual fracture and irregular diameter with poor wire surfaces. Care should be taken when drawing wire on spools to keep correct tension. Wire for annealing should not be tightly wound as it is liable to burst during heating and is very difficult to wind off afterwards. If, however, the wire is to be run off in the hard drawn state, tight winding, without excessive strain is an advantage. Modern machines control the tension in accordance with requirements. Wire for re-drawing should be perfectly clean and free from tarnish or oxidization; pre-annealed wire should be free from hard patches and of uniform malleability. Patches of oxide create a succession of hammer-like blows causing fracture and excessive die wear.

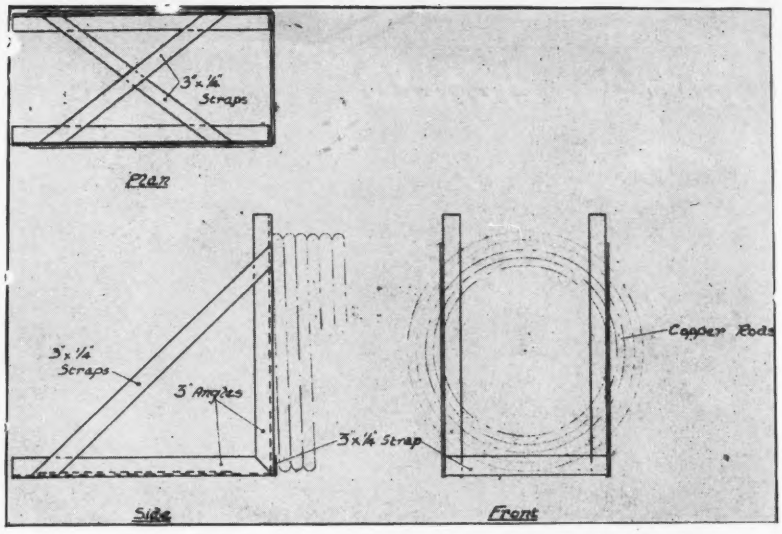

Fig. 9 — Stacking of Rods

* * * * * *

* * *

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The Wire Association is a non-profit organization of wire and wire products mill superintendents, executives and foremen, whose specific purpose is to improve production methods and afford a clearing house for ideas on management, technical and research problems, and to develop and maintain friendly relations among members.

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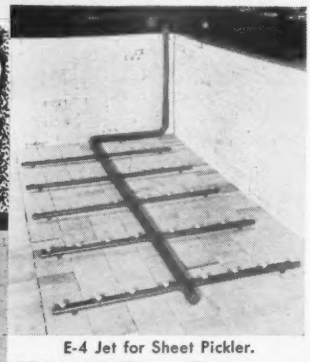

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WIRE and WIRE PRODUCTS

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drawing machines, and heavy clutches have been designed for the purpose. A **Robertson** 16 die Superfine Wire Drawing machine is shown in Fig. 8. Capacity from 0.0148 to finish 0.0020 in. Drawing speed 3,000 or 4,000 ft./min.

* * *

THE **"Statobloc"** system is interesting. In this machine the die rotates and the wire falls in loose coils on to a storage drum from which it can be removed at leisure without interruption of the drawing operation. Recoiling or rewinding is costly and arrangements are sometimes made for drum winding direct from the bench. Allowance is made for the build-up on the drum by means of a variable speed gear or a slipping clutch.

Storing, Loading and Handling

METHODS in handling and storing of copper rods depend on their supply. When rods are obtained in bulk lots of from 100 to 500 tons, inside storage is inconvenient and unnecessary, as copper does not deteriorate in the open. The stock ground should be as near to the pickling plant as possible, and stacking or laying out of the rods should be made in such a way as to enable one man to handle the rods singly or in rows of about 10 coils. A mobile stacking truck is an ideal way of carting wire rods, carrying 9 or 10 coils, each weighing about 250 lbs. and if the rods are stacked in rows and on edge upright, one man can easily handle them (Fig. 9). For limited stock space a jib crane is very useful allowing rods to be stacked 5 or 6 rows high. Transport of rods either by lorry or rail should be so arranged as to allow the coils to be stored in rows so that a long bar can be passed down the centre and lifted with lots suitable to whatever unloading tackle is available. When lorries deliver daily in quantities balancing requirements, the stacking truck comes into its own, unloading and depositing the rods right at the pickling plant. A certain amount of inside storage space is necessary and desirable to cover periods when delivery fails or trucks are not available, also when inclemental weather makes it

inconvenient to draw from outside stocks. Where conditions do not allow of cranes or overhead runways, a wharf as near the inwards door as possible and at lorry platform height, is very convenient, allowing unloading by means of porters truck or stacking truck. Inside storage and pickling plant should be as near the inward doors as possible to shorten handling and transport time. Efficient planning on these lines saves costs of raw material piling up before processing. The overhead runway, even with electric hoist, except for the actual pickling process, is insuitable for unloading wire rods, being limited in the area it can cover without the use of junctions and numerous branches. Non-ferrous wire rods should not be stacked on ashes as these may contain free sulphur which attacks the metal. Asphalt is also unsuitable as in very hot weather, pitch will become soft and stick to the rods. Furthermore, great weight of metal will distort and break up the asphalt surface. Concrete, with roughened surface and narrow shallow corrugations, forms the best stacking ground, preventing the coils from slipping flat and keeping the rows upright and in line, allowing the stacking truck bar, or hoisting tackle hook, to be easily inserted down the centre. The practice of unloading rods from lorry or truck by rolling the coils down a ramp is labouring and dangerous, those handling the rods running the risk of badly lacerated hands from ends of wire binders and rod ends, unless well protectd by leather gloves. There is also the danger of strain or wrench in the effort to keep the coils upright.

General Plant Lay-Out

THE general lay-out of a wire plant depends, of course, upon tonnage and class requirements. The given suggestions (Fig. 4) deal chiefly with copper wire for electric cable manufacture, but with certain modifications, the general ideas may cover most non-ferrous wire drawing. It is very important when laying down machines to leave enough space near each, for a similar type, to meet future re-

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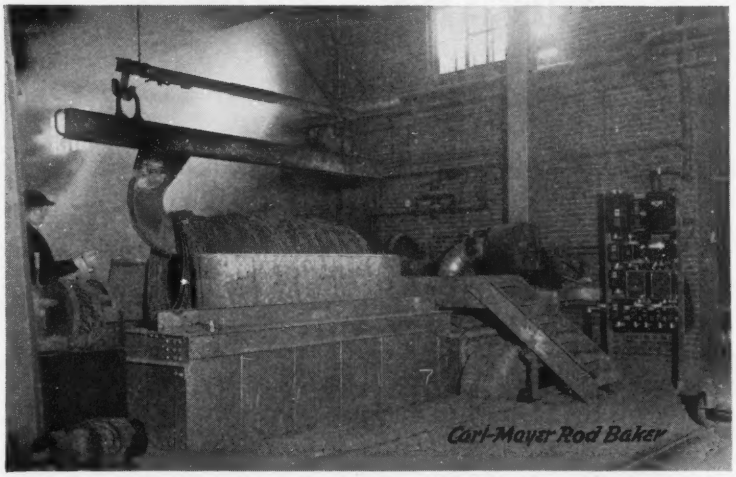

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STATEMENT OF OWNERSHIP, management, circulation, etc., required by the Acts of Congress of August 24, 1912 and March 3, 1933, of Wire & Wire Products published monthly at New York, N. Y., for October 1, 1946.

State of Connecticut, County of Fairfield, ss.: Before me, a Notary Public in and for the State and county aforesaid, personally appeared Richard E. Brown, who, having been duly sworn according to law, deposes and says that he is the President of Wire & Wire Products and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publishers, editor, managing editor, and business managers are:
Publisher, Quinn-Brown Publishing Corporation, 300 Main St., Stamford, Conn.; editor, Richard E. Brown, 300 Main St., Stamford, Conn.; managing editor, none; business manager, Richard E. Brown, 300 Main St., Stamford, Conn.

2. That the owner is: (if owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, companay, or other unincorporated concern its name and address as well as those of each individual member must be given.) Quinn-Brown Publishing Corporation, 300 Main St., Stamford, Conn.; Richard E. Brown, 300 Main St., Stamford, Conn.; Leta B. Brown, Montecito, California, and Ruth S. Spengel, Shore Front Park, South Norwalk, Conn.

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RICHARD E. BROWN
(Publisher)

Sworn to and subscribed before me this 9th day of September, 1946.

JAMES A. WEIR,
Notary Public.

My commission expires April 1, 1947.

quirements. This saves duplication of supply plant and the space left open is very useful, until required, for storage of processed wire, etc.

* * *

AN overhead runway with electric hoist for 5 cwt. load for supplying pickled rods to tandem machines from soap storage tanks is a necessity. This hoist should be in addition to the one used in the actual pickling process. Shallow open drains, covered with either wooden or metal grids, should be laid round all wire drawing machines. The drains should lead to a large sump to trap solidified grease, oil and heavy dirt preventing opening of the main drains. A good concrete bed is necessary for the large tandem wire drawing machines as the weight and high speeds of modern machines require firm foundations.

* * *

A good floor surrounding is blue brick laid on a concrete bed, as this type of floor is very easily kept clean, and does not hold the grease and dirt, as does a concrete surface.

* * *

WITH ample open drains it becomes very simple to swill down the surroundings; water supply pipes of ample diameter should be installed near each machine. Water used in the cooling process, or any other clean waste water, can be collected in an underground tank and by means of a pump be utilised in rod washing at the pickling plant. As far as possible, machines of the same make are installed, preventing duplication of spares, and simplifying maintenance. If wire is drawn in coils, 22 in. blocks should be standard for gauges from 0.160 in. down to 0.056 in. as this allows wire swifts to be standardised, and also enables 8 in., 10 in., or 12 in. coils to be placed inside the 22 in. coils during annealing.

* * *

MACHINE lay-out should be progressive, that is, large tandems, medium and fine wire machines. Where spool drawing is the practice and re-drawing without intermediate annealing possible, the flow of wire from one process to

another is greatly simplified and prevents cross supply with consequent over handling.

* * *

WIRE for annealing should be taken from the stocks and put straight into the furnace without being handled a second time. All trucks used in wire transporting, as supplied by special firms, should be as low loading as possible to allow ease in handling and loading of the wire.

* * *

Recommendations by the Die Makers Committee of the Industrial Diamond Association of America, Inc.

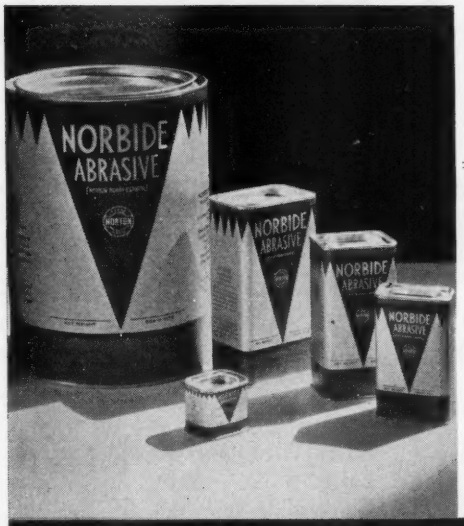
THE first convention of the Industrial Diamond Association of America was held at the Book-Cadillac Hotel, Detroit, Michigan, July 16th-18th.

* * *

RESEARCH towards further progress and continued improvement of ethical relations within and without the diamond industry were assured by the composition of seven committees appointed by president Harvey B. Wallace (Wheel Trueing Tool Company) unanimously approved by Directors, 1st vice-president I. J. Meade (U. S. Industrial Diamond Corporation), Charles J. Koebel, 2nd vice president (Koebel Diamond Tool Company), Irving B. Berk (Midwest Diamond Sales Company) Louis Chambre (Balloffet Dies and Nozzle Company) Stephen W. Hofman, Frank E. Koebel (J. W. Smit Company) Harold De S. Mendes (Mendes Diamond Sales Company) James A. Ross (Sprague and Henwood Inc.) W. R. Spandel (H. R. Spandel Inc.) and Charles Ullman (Associated Diamond Company).

* * *

THE committee, appointments to which were unanimously ratified by the delegates from 80% of I.D.A.'s membership, were: **MEMBERSHIP AND PRACTICES:** F. E. Koebel **RESEARCH:** H. E. Robinson (Wheel Trueing Company) **TOOLMAKERS:** William J. Sansome (Koebel Diamond Tool Company) **IMPORTERS:** D. Van Italler



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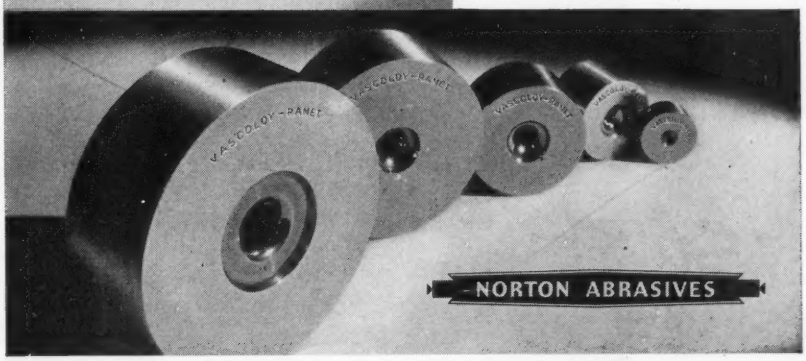

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Diemakers: F. Durand (Cochaud Wire Die Company) **PUBLIC RELATIONS:** Vice President I. J. Meade **FINANCE** Charles Ullman.

* * *

THE Wire Drawing and Die Makers Committee, consisting of Mr. Fernand Durand, Mr. Louis L. Chambre, Balloffet Dies & Nozzle Co., Guttenberg, N. J., Mr. John W. Cowan, Wayne Wire Die Company, Hillside, N. J., Mr. Paul Bieberich, Fort Wayne, Wire Dies, Inc., Ft. Wayne, Ind., Mr. Otis Ferrier, Indiana Wire Die Inc., Ft. Wayne, Ind., and Mr. W. E. Roux, Roux Wire Die Works, Inc., Oriskany, N. Y. made a report to the Convention in which it was reported that during the war a considerable proportion of cuttable goods had been assigned to the diamond die industry, that this condition will no longer prevail and that from now on the diamond die industry will be compelled to use a type of stone previously considered of lower quality. Consequently, the die makers will not be in a position to supply the high quality die heretofore produced. In addition to the above, not only diamonds in general are imported at a higher cost, but due to the small quantity of suitable die stones obtained in each parcel their cost will be increased in proportion.

* * *

IT was felt that these radically changed conditions should be brought to the attention of the wire producers, and the committee recommended that the above information be released to the Industry through the medium of WIRE AND WIRE PRODUCTS.

* * *

FURTHER recommendations were as follows:

(1) **DIE MANUFACTURERS — A strong recommendation is made to the Membership Committee that a concentrated drive be started to urge any die manufacturer not now affiliated with the Association to join the group for the ultimate benefit of both the industry and the wire manufacturers.**

(2) **STANDARDIZATION — To develop a comprehensive program of standardization such as a standard weight for standard dies from the various size ranges.**

(3) **FAIR PRACTICES — Every effort will be made to encourage fair trade practices within the industry and all members pledge to live up to the code of ethics of I. D. A.**

(4) **RESEARCH — The Die Makers Committee goes on record wholeheartedly to offer its cooperation to the Research Committee and request in return that all new developments and patents within the industrial diamond industry be made available to the diamond die producers within the association.**

* * *

ALL of the above recommendations were unanimously approved by the members.

* * *

Applications of Fiberglas to Wire and Cable

(Continued from page 888)

wire and cable construction where the final operation is a lacquered coating of the textile braid. In many of these uses dyed Fiberglas yarn is employed.

* * *

LARGE quantities of radio hookup wire employing Fiberglas yarn outer braid were used during the war. Inasmuch as a lacquered coating does not physically support the individual glass fibers in the same manner as a saturant or impregnant for applications involving flexing or abrasive action in service, precautions should be taken. The Fiberglas braid or serving may be coated with a saturant prior to lacquering, or alternate carriers of Fiberglas yarn and other type textile yarns may be used in the braiding operation to provide the desired abrasion resistance.

* * *

FIBERGLAS yarns are supplied in packages of all the types generally found in the wire and cable industry. They have been satisfactorily applied on practically every type of standard yarn serving or braiding equipment. Because of lack of stretch in the yarns, minor adjustments of the equipment are sometimes necessary. A tension adjustment differing from that used for other types of yarns in some cases gives improved operation with Fiberglas yarns. Sharp corners or rough surfaces in the serving or braiding equipment should be avoided. The wire or

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cable should be impregnated, saturated or lacquered as soon after the textile covering application as possible, avoiding physical abuse of the unimpregnated textile covering.

* * *

THE increasing applications of Fiberglas yarns are made possible by engineers and production men of the wire and cable industry who are taking advantage of the characteristics of Fiberglas. It is being treated as a new basic material by these people, and in turn provides them with a means of producing wire and cable of superior performance quality. Careful design work and persistent effort to improve production techniques have enabled the industry to provide their customers with better products using Fiberglas at economically justified prices.

* * *

Wire Association Questions & Answers

The Wire Association is for the specific purpose of improving production methods. It has been organized as a clearing house of ideas on technical problems and research work in all phases of practical wire drawing and wire working.

The inquiries discussed were received from and answered by members of the Wire Association. These inquiries are sent to the Secretary of the Association who acts as a central clearing point, and neither the names of the firms, nor individuals sending the inquiry, nor of the men or firms replying are divulged without permission.

Question No. 1101

"It is our normal practice to clean our mild steel rods in a Sulphuric Acid Pickling Bath ranging in strength from 8% down to 1.0/ 1.5%. The temperature is maintained in the range of 180/190°F. We are using Rodine as an inhibitor and foaming agent. The steel which we are cleaning is made in our Electric Arc Furnaces and the bulk of it is rolled to #5 rod for use in our Wire Mill. Average chemical analysis of our rods would run about as follows:

Carbon	.06/.14
Manganese	.30/.50
Phosphorus	.010/.030
Sulphur	.025/.050
Silicon	.01/.12
Copper	.12/.32

We have found that on occasion certain rods, when introduced into the pickling bath, will react so violently with the bath and with such a strong evolution of gas as to "boil" the bath over the top of the tub, resulting in a considerable loss of acid and an increase in acid cost. Samples

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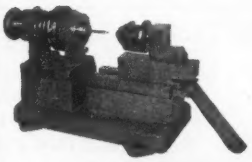

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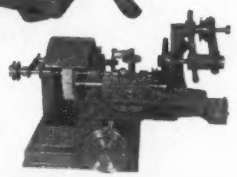

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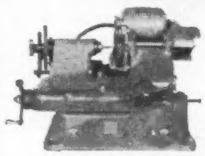

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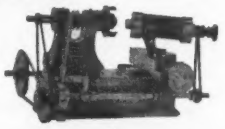

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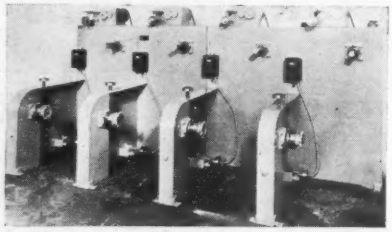

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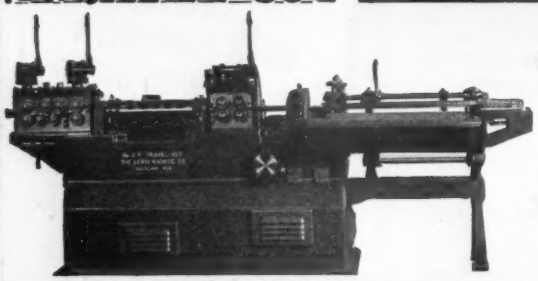

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of rods causing this trouble have, over a period of time, been analyzed and almost invariably we have found them to run excessively high in copper content. Because of their violent reaction with the bath we have found these rods particularly apt to "burn" and pit if left in the bath any length of time at all.

I wonder if you have any record of others having the same sort of troubles in cleaning rods, and an explanation as to why such reaction should take place. Could you suggest any solution for this type of trouble?

I am not certain that the copper content of the steel is the prime factor in causing this action, but it does seem reasonable to me that it might be, in the light of our past experiences. By extremely high copper contents I refer to copper values of the range of .32/.50, or rarely, even higher. This trouble is not a regular occurence, but crops up from time to time and does cause serious trouble when it does occur."

★ ★ ★

Answer No. 1

"Regarding your letter on pickling mild steel rods with a high copper content.

We know that high copper in rods will cause the surface to be full of very small scabs or slivers. These slivers may all pickle off or come off in the drawing operation, but nevertheless they are present when the rod coil goes into the pickling bath. It seems reasonable to assume that the added surface area, due to these slivers, could cause just such a violent reaction as mentioned in your letter.

If the member that wrote you has the analysis of the rods before he pickles them it would be a simple matter to hold out these high copper heats and pickle them in a bath that was pretty well run down and the acid was below 3%."

★ ★ ★

Answer No. 2.

"In reply to your letter, "Concerning the difficulties in rod cleaning," will say that the analysis of rods and the practice outlined in the member's letter is substantially the same as our own with the exception that our rods generally are low-carbon, open-hearth, basic rods. We are quite sure that there is practically no copper content in the rod analysis.

We have no trouble in pickling such as described, therefore, are at a loss to make any suggestion to correct the trouble that the member is having."

★ ★ ★

Answer No. 3

"In reference to your letter concerning the question of rods boiling in the acid tub when cleaned, I would like to advise you that we have never experienced this condition in our mills, nor have I ever seen this condition present during any of my contacts with the wire industry."

★ ★ ★

Answer No. 4

"We have had no experience in cleaning rods produced from steel made in an Electric Arc Furnace. However, from the description of the strong evolution of gas which occurs when these rods are immersed in a cleaning tub, we are reminded of a similar reaction which occurs when Acid Bessemer rods are cleaned. It has been noted that when our pickle tub temperature is high — say, around 6% to 8% by weight, and the iron concentration low — say, under 2%, Bessemer steel causes a strong evolution of gas in the pickle bath even though an inhibitor is used.

To avoid this "boil" and consequent over-pickling of the steel, it is best to do one or more of the following things:

(1) Reduce temperature to possibly 130° F.

(2) Arrange cleaning schedules so that these rods are cleaned in a used tub with iron content around 4% and acid down around 3%.

I am not sure that the above has a direct bearing on electric furnace steel but I hope that the information will be of some help to you."

* * *

Wean Equipment Corporation Acquires Broden Construction Company

SO that the Company may be more readily identified with its ownership and its products (strip steel and wire mill equipment), the stockholders of **The Broden Construction Company** have deemed it advisable to change the name of the Company to **Wean Equipment Corporation.**

* * *

THE Wean Equipment Corporation's physical properties include the entire completely equipped plant of The Broden Construction Company and in addition all of the buildings, machinery and facilities that were originally furnished by the Reconstruction Finance Corporation to meet Broden's wartime needs. This means that the Wean Equipment Corporation has available for its customers' use over 50,000 square feet of building area well equipped with the most modern machine tools, cranes and assembly area for the production of strip steel and wire mill machinery.

* * *

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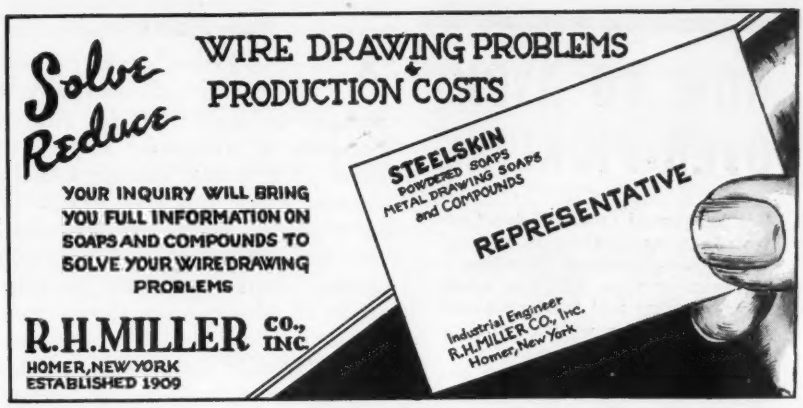
* * *

THE Company is cooperating with the Veterans Rehabilitation Training Program in offering on-the-job training to veterans for welders, machinists, assemblymen and engineering draftsmen. A similar training program is also offered to civilians.

* * *

THE strategic location of the Wean plant in Euclid, Ohio, on the main line of the New York Central Railroad, provides excellent and adequate shipping facilities. Its location, in the midst of a desirable home neighborhood, has made it possible to build the working force to a maximum and maintain full capacity operations. The address of The Wean Equipment Corporation Main Office is 22800 Lakeland Blvd., Cleveland, Ohio.



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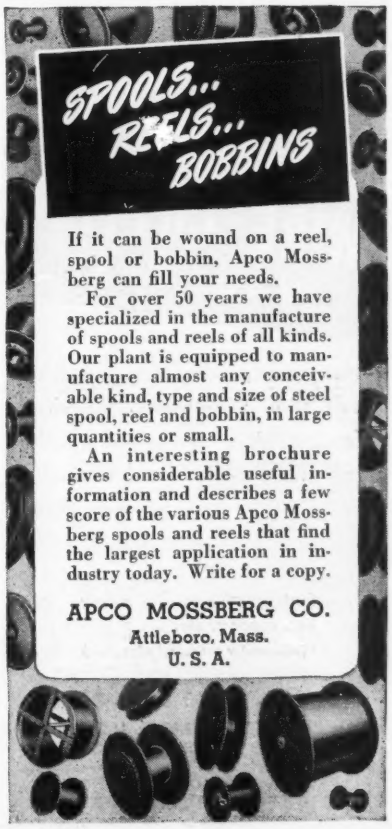

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* * *

WHEN all other types of aluminum oxide abrasive are produced in the electric furnace the crystals form in a solid mass, the size and shape of each crystal being affected by the adjacent crystals. Thus they bear no relation to the size and shape of the final grains and a crushing operation is necessary to reduce the abrasives to grains of commercial sizes.

* * *

THE grains of this new abrasive, however, form in the electric furnace as single, individual crystals which do not require any crushing to size. Inasmuch as the crystals form individually they assume a chunky, nubbly shape. The many plane surfaces form both exterior and reentrant dihedral angles, the latter making definite rake angles which increase the cutting efficiency of the grains.

* * *

THE new and special electric furnace process by which this abrasive is made was invented by and is patented by Norton Company. Essentially it consists of fusing high purity aluminous ores in the electric furnace in such a manner that individual crystals of commercial grain sizes are formed in a fluid matrix. The high-purity, chemically stable crystals are then separated from the matrix by a complicated, continuous chemical process. Without crushing, the naturally formed crystals are screened into standard grain sizes.

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New Book on Scientific Instruments

THE **Chemical Publishing Company**, 26 Court Street, Brooklyn 2, N. Y., has published a book **"Scientific Instruments"** that should prove of interest to many metallurgists and other engineers in the wire industry who have to do with materials testing. It is edited by Herbert J. Cooper, Head of the Engineering Department, South West Essex Technical College. It contains 304 pages and costs $6.00. Fifteen specialists and a large number of companies have contributed to the work.

* * *

THIS book covers the field of instrumentation and its basic principles in a clear and concise manner. Many diagrams and photographs are reproduced to facilitate the understanding of many types of mechanism and their utilization.

* * *

FIVE categories of instruments are dealt with. Among the items covered are many varieties of optical devices; equipment to measure density, pressure, temperature, time, speed; navigational and surveying instruments. There is also a section on hardness testers, vacuum tubes, and miscellaneous devices.

* * *

THE book contains very simple mathematics. There are references at the end of each chapter. Much equipment described is not only for laboratory purposes but is also commonly used in many sections of industrial production.

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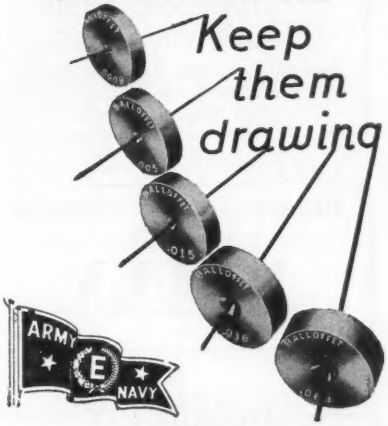

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A Selection of Methods for Polishing Metallographic Specimens

(*Continued from page* 883)

Illustrations

FIGURE 4 shows the results from each wheel when polishing Bessemer screw stock using the twisting motion on the sample to produce random scratch direction. It was estimated that 90 to 95% of the inclusions were intact over the entire surface of the sample.

* * *

FIGURE 5 again shows the results from each wheel but this time on gray cast iron. In this case many of the graphite flakes were lost. Flakes of graphite laying flat in the plane of polish could be retained.

* * *

FIGURES 6 and 7 are included to illustrate the clear definition of true structure that can be resolved by removal of distorted metal or metal flow.

* * *

THE phenomenon of grain growth in low carbon steel is illustrated in Figure 6. The specimen was taken from a stamping that had been annealed after having been critically strained in the press operation. After polishing and etching in the usual way the sample was repolished on the final wheel and re-etched and then again repolished and re-etched.

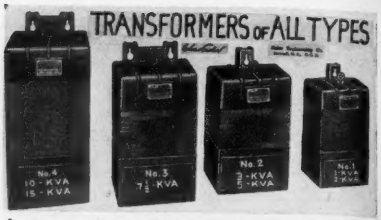
* * *

FIGURE 7 shows coarse lamellar pearlite in 1.00% carbon tool steel after repolishing and re-etching only one time.

* * *

A NOTABLE advantage of this method is illustrated in Figures 8 and 9. Edges are kept flat for sharp focus at reasonable magnifications. This is particularly necessary when studying surface effects produced by heat treatment or in measuring plate thickness. A large percentage of error can be introduced in the measurement of plate thickness simply by improper focus resulting from rounded edges.

* * *



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IN conclusion it may be stated that this method of polishing meets the general requirements very acceptably with the element of skill playing a much lesser role. Each wheel performs its task without much training or experience on the part of the operator. The weight of the sample supplies enough pressure on each of the wheels and amount of abrasive is not critical. It is therefore probably most suitable for those laboratories which do not employ a full time polisher.

Western Metal Congress and Exposition

PRELIMINARY plans for resumption of the Western Metal Congress and Exposition have been completed and the event will be held in the San Francisco-Oakland Golden Gate area for six days beginning March 22, 1947. The last such event was held in Los Angeles in 1941.

* * *

THE Western Metal Congress and Exposition will again be sponsored by the American Society for Metals and will have the active cooperation of West Coast chapters of the nation's leading technical societies.

* * *

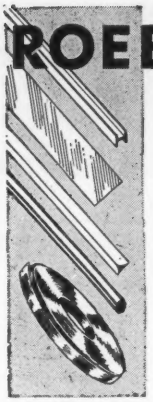
TECHNICAL programs will include lecture courses, technical papers and round table conferences of special interest to the metals, aviation, petroleum, chemical, mining and general manufacturing industries. Further announcements of this program will be made at a later date.

* * *

IN the Exposition will be shown a complete cycle of equipment and methods relating to the metals industries, including raw materials, heat treating apparatus and supplies, inspection methods and equipment, machinery, foundry supplies, materials handling, welding and cutting, oil field equipment, small tools and finished products.

* * *

TECHNICAL sessions of the Congress and exhibits in the Exposition will be housed in the two large civic auditoriums at Oakland.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* * *

MANUFACTURERS are consequently forced to adopt methords of obtaining labour which have not applied to date, many of them initiated welfare schemes and in a variety of other ways attempting to increase their labour force.

* * *

THE policy of placing the advantages and opportunities before prospective workers has been adopted in several industries with definite results. In Edinburgh, the Chamber of Commerce has prepared an excellent booklet giving in concise factual detail the opportunities and openings in various industries in the city including the wire working industry.

* * *

IN this, as in other industries, the Chamber drew on official data to outline the scope and nature of the industry, the standards desired, the wages and the prospects for those entering it. This may serve as a useful guide to what is being done in this direction by one community. The survey states the trade of Wireworking and Ironworking embraces, with a few specialised exceptions, almost every sphere of the manufacture of Wire Goods and relative Ironwork. There is only one large firm in the East of Scotland, there being a few one-man businesses. There are, however, several large Wireworking shops in the West, notably in the Glasgow district. Future prospects, like new avenues of development, are at the moment fairly uncertain, but will develop in the main according to the policy pur-

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* * *

A Review of Recent Wire Patents

(*Continued from page* 904)

by portions of the wire. This thread cooperates with the grooves to prevent slippage of the wire.

* * *

No. 2,408,155, COMPOSITION FOR AND METHOD OF CLEANING AND COATING METAL, patented September 24, 1946 by Sydney G. Thornbury, Los Angeles, Calif., assignor to Turco Products, Inc., Los Angeles, Calif., a corporation of California.

The composition for removing oil, grease metal oxide and the like from the metal, and for depositing a metallic phosphate coating on the metal, comprises a solution consisting of water, phosphoric acid, aromatic petroleum solvent, and a coupling agent comprising, by weight, 25-33% of butanol and 21-29% of ethanol.

* * *

No. 2,408,201. CLOTHES HANGER, patented September 24, 1946 by Charles Manuel Derderian, Richmond, Va.

Associated with the wire coat hanger of more or less conventional shape is a coat lapel holder, also mostly of wire.

* * *

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WHERE TO BUY

For more complete information, consult the annual Wire and Wire Products Directory, Index & Buyers' Guide.

ABRASIVES—
Norton Co., Worcester, Mass.

ACID INHIBITORS—
American Chemical Paint Co., Ambler, Pa.
Oakite Products, Inc., New York, N. Y.
Parkin, Wm. M., Co., Pittsburgh, Pa.

ACID-PROOF CONSTRUCTION—
Ceilcote Co., The, Cleveland, Ohio.
Haveg Corporation, Newark, Del.
Heil Process Equipment, Corp., Cleveland, Ohio.
Sauereisen Cements Co., Pittsburgh, Pa.

AIR DRAW FURNACES
Carl-Mayer Corp., Cleveland, Ohio.

ALKALINE CLEANERS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Oakite Products, Inc., New York, N. Y.

ANNEALING MACHINES—Open Flame
Syncro Machine Co., Perth Amboy, N. J.

ANNEALING POTS AND BOXES—
National Annealing Box Co., Washington, Penna.
Scudder, E. J., Foundry & Machine Co., Trenton, N. J

ARMORING EQUIPMENT—
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

BAKERS—Rod and Wire
Carl-Mayer Corp., The, Cleveland, Ohio.
Morgan Construction Co., Worcester, Mass.
Moslo Machinery Co., Cleveland, Ohio.
Ross, J. O., Engr. Corp., New York, N. Y.

BENDERS—
O'Neil-Irwin Mfg. Co,. Minneapolis,. Minn.

BOBBINS—Braider & Wire Weaving
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

BORON CARBIDE
Norton Co., Worcester. Mass.

BRAKES—Pneumatic
Entwistle, Jas. L. Co., Pawtucket, R. I.

BRAKES & SHEARS—
O'Neil-Irwin Mfg. Co., Minneapolis, Minn..

BRICKS—Acid Proof
Keagler Brick Co., Steubenville, Ohio.

CABLE LACQUERING OVENS
Industrial Ovens, Inc., Cleveland, O.

CABLE—Steel and Copper
Jones & Laughlin Steel Corp., Pittsburgh, Pa.

CARRIERS—Braider, High Speed
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.

CASTINGS—Wire Mill
Scudder, E. J. Fdry. & Mach. Co., Trenton, N.J.

CEMENTS—Acid Proof
Sauereisen Cements Co., Pittsburgh, Pa.

CEMENTS—Refractory
Norton Co., Worcester, Mass.

CHEMICALS—Cleaning
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Oakite Products, Inc., New York, N. Y.
Parkin, Wm. M., Co., Pittsburgh, Pa.
Standard Industrial Compounds Co., Chicago, Ill.

CLEANERS—Hand and Metal
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Phila, Pa.
Magnus Chemical Co., Garwood, N. J.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

CLEANING & PICKLING EQUIP.—
Cleveland Tramrail Div., of the Cleveland Crane & Engineering Co., Wickliffe, O.
Haveg Corp., Newark, Del.
Heil Process Equipment Corp., Cleveland, Ohio.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

CLOTH TESTERS—
Scott Testers, Inc., Providence, R. I.

CLOTH—WIRE. All Metals
Reynolds Wire Co., Dixon, Ill.
Roebling's John A. Sons, Co., Trenton, N. J.

COATING COMPOUNDS—
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

COILERS—Sheet, Strip and Wire
Entwistle, Jas. L. Co., Pawtucket, R. I.
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J. Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.
Wean Equipment Corp., Cleveland, Ohio.

COLD HEADERS—
Waterbury-Farrel Foundry & Machinery Co., Waterbury, Conn.

COMPOUNDS—Coppering
American Chemical Paint Co., Ambler, Pa.

COMPOUNDS—Metal Finishing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.

COMPOUNDS—Rust Preventing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Oakite Products, Inc., New York, N. Y.
Shell Oil Co., Inc., New York, N. Y.

COMPOUNDS—Rust Removing
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Phila, Pa.
Oakite Products, Inc., New York, N. Y.
Shell Oil Co., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

COMPOUNDS—Wire Drawing
Apex Alkali Products Co., Phila., Pa.
Bick, Hans C., Inc., Reading, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H. Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Potter, Neil C., Newark, N. J.
Shell Oil Co., Inc., New York, N. Y.
Standard Industrial Compounds, Co., Chicago, Ill.

COPHOLDERS—Steel
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

CRANES—Wire Mill
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

CUTTING TOOLS—Carbide
Carboloy Co., Inc., Detroit, Mich
Firth-Sterling Steel Co., McKeesport, Pa.
Vascoloy-Ramet Corp., North Chicago. Ill.

CUTTING TOOLS—Wire
Porter, H. K., Inc., Everett, Mass.

DIAMONDS—Industrial
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N.J.
Michigan Wire Die Co., Detroit, Mich.
Rusch Wire Die Corp., Croton-on-the-Hudson, N.Y.
Vianney Wire Die Wks., New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIAMOND POWDERS—
Michigan Wire Die Co., Detroit, Mich.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-the-Hudson, N.Y.
Wayne Wire Die Co., Hillside, N. J.

DIAMOND TOOLS—
Rusch Wire Die Corp., Croton-on-the-Hudson, N.Y.
Wayne Wire Die Co., Hillside, N. J.

DIES—Diamond
Ajax Industrial Supplies, Inc., Fort Wayne, Ind.
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N.J.
Cochaud Wire Die Corp., New York, N. Y.
Ft. Wayne Wire Die, Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Michigan Wire Die Co., Detroit, Mich.
New England Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-the-Hudson, N.Y.
Vianney Wire Die Wks., New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.

DIES—Lead Extrusion
Wayne Wire Die Co., Hillside, N. J.
Robertson, John, Co., Brooklyn, N. Y.

DIES—Repairs & Re-Cutting
Ajax Industrial Supplies Co., Fort Wayne, Ind.
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N.J.
Carboloy Co., Detroit, Mich.
Cochaud Wire Die Corp., New York, N. Y.
Firth-Sterling Steel Co., McKeesport, Pa.
Ft. Wayne Wire Die, Inc., Fort Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Michigan Wire Die Co., Detroit, Mich.
New Eng. Wire Die Co., Worcester, Mass.
Rusch Wire Die Corp., Croton-on-the-Hudson, N.Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Wks., New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Rod and Tube Drawing
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N.J.
Carboloy Co., Inc., Detroit, Mich.
Firth Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Michigan Wire Die Works, Detroit, Mich.
Rusch Wire Die Corp., New York, N. Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Wks., New York, N. Y.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Tantalum Carbide
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N.J.
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Rusch Wire Die Corp., Croton-on-the-Hudson, N.Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Wks., New York, N. Y.
Willey's Carbide Tool Co., Detroit, Mich.

DIES—Tungsten Carbide
Balloffet Dies & Nozzle Co., Inc., Guttenberg, N.J.
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Kelly Wire Die Corp., New York, N. Y.
Metal Carbides Corp., Youngstown, O.
Michigan Wire Die Co., Detroit, Mich.
Rusch Wire Die Corp., Croton-on-the-Hudson, N.Y.
Vascoloy-Ramet Corp., North Chicago, Ill.
Vianney Wire Die Wks., New York, N. Y.
Wayne Wire Die Co., Hillside, N. J.
Willey's Carbide Tool Co., Detroit, Mich.

DRAW BENCHES—
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E J. Fdry. & Mach. Co., Trenton, N. J.
Standard Machinery Co, Providence, R I.
Vaughn Machinery Co., Cuyahoga Falls, O.

DRUMS—Flange Steel
Hubbard Spool Company, Chicago, Ill.
Stevens Metal Products Co., Niles, Ohio.

DRUMS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.

DRYING & PRE-HEATING ROOMS—
Carl-Mayer Corp., Cleveland, Ohio.
Industrial Ovens, Inc., Cleveland, Ohio.

DRYING EQUIPMENT—
Carl-Mayer Corp., The, Cleveland, Ohio.
Ross, J. O., Engineering Corp., New York, N. Y.

ENGINEERS—Consulting Wire Mill
Lewis, Kenneth B., Worcester, Mass
Syer, C. Raymond, Westport, Conn.
Wiel, L. D., New York, N. Y.

EQUIPMENT—Insulation Testing
Entwistle, James L., Co., Pawtucket, R. I

EYELETS—Brass or Zinc
Platt Bros., & Co., The, Waterbury, Conn.

FLUXES—Soldering
American Chemical Paint Co., Ambler, Pa.

FOAM PRODUCING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Parkin, Wm. M. Co., Pittsburgh, Pa.

FRICTION PAY-OFF STANDS—
Industrial Ovens, Inc., Cleveland, Ohio.

FURNACES—Annealing
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Furnace Engineers, Inc., Pittsburgh, Pa.
Surface Combustion Corp., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Automatic
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Surface Combustion Corp., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

WHERE TO BUY, Continued

FURNACES—Brazing
Electric Furnace Co., Salem, Ohio.
Firth-Sterling Steel Co., McKeesport, Pa.

FURNACES—Bright Annealing
Electric Furnace Co., Salem, Ohio.
Furnace Engineers, Inc., Pittsburgh, Pa.
Surface Combustion Corp., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Electric
Eisler Engineering Co., Newark, N. J.
Electric Furnace Co., Salem, Ohio.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Galvanizing Equipment
Electric Furnace Co., Salem, Ohio.
Furnace Engineers, Inc., Pittsburgh, Pa.
Sleeper & Hartley, Inc., Worcester, Mass.
Surface Combustion Corp., Toledo, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

FURNACES—Hard'ing & Temp'ing
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Lead Melting
Electric Furnace Co., Salem Ohio.
Furnace Engineers, Inc., Pittsburgh, Pa.
Robertson, John, Co., Brooklyn, N. Y.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Non-Oxidizing
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Furnace Engineers, Inc., Pittsburgh, Pa.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Normalizing
Carl-Mayer Corp., The, Cleveland, Ohio.
Electric Furnace Co., Salem, Ohio.
Furnace Engineers, Inc., Pittsburgh, Pa.
Surface Combustion Corp., Toledo, Ohio.

FURNACES—Salth Bath
Electric Furnace Co., Salem, Ohio.
Surface Combustion Corporation, Toledo, O.

FURNACES—Wire, Strip & Sheet
Carl-Mayer Corp., The, Cleveland, Ohio.
Eisler Engineering Co., Newark, N. J.
Electric Furnace Co., Salem, Ohio.
Furnace Engineers, Inc., Pittsburgh, Pa.
Surface Combustion Corporation, Toledo, O.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

GALVANIZING KETTLES—
National Annealing Box Co., Washington, Penna.

GOVERNMENT SURPLUS MATERIALS
War Assets Corporation, New York, N Y.

GRINDERS—Roll
Norton Co., Worcester, Mass.

HOISTS—Electric Travelling
Cleveland Tramrail Div. of Cleveland.
Crane & Engineering Co., Wickliffe, Ohio.

INHIBITORS—Pickling
American Chemical Paint Co., Ambler, Pa.
Oakite Products, Inc., New York, N. Y.
Parkin, Wm. M. Co., Pittsburgh, Pa.

INSULATING LACQUERING SYSTEMS—Continuous
Industrial Ovens, Inc., Cleveland, Ohio.

INSULATING MATERIALS—
Crepe-Kraft Co., Newark, N J
Standard Varnish Wks., Staten Island, N. Y.

KETTLES—Galvanizing, Annealing, Tinning, etc.
National Annealing Box Co., Washington, Penna.

LATHES—Die Reaming
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Morgan Construction Co., Worcester, Mass.
Roos, H. & G., Tool & Mfg. Co., Montclair, N.J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Machine Co., Waterbury, Conn.

LININGS—Acid and Alkali Proof
Ceilcote Co., The, Cleveland, Ohio.
Haveg Corp., Newark, Del.
Heil Process Equipment Corp., Cleveland, Ohio.

LUBRICANTS—For Metal Cutting, Stamping and Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

LUBRICANTS—Wire Drawing
Apex Alkali Products Co., Phila., Pa.
Bick, Hans C., Inc., Reading, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Potter, Neil C., Newark, N. J.
Standard Industrial Compounds Co., Chicago, Ill.

MACHINERY—Armoring (Cable, Wire Hose)
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Braiding
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Wire & Textile Mach'y, Inc., Pawtucket, R. I.

MACHINERY—Brazing
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Bunching
American Insulating Mach'y Co., Phila, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Bundling, Scrap
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Cable, Electric
American Insulating Mach'y Co., Phila, Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Chain Making
Nilson, A. H. Machine Co., The, Bridgeport, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Cable, Rope Closing
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Coil Winding
Entwistle, Jas. L. Co., Pawtucket, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Coilers
Eisler Engineering Co., Newark, N. J.
Entwistle, Jas. L. Co., Pawtucket, R. I.
Morgan Construction Co., Worcester, Mass.
New England Butt Co., Providence, R. I.
Ruesch, H. J. Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Waterbury Farrel Fdry. & Mach. Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Copper Wire Drawing and Rolling
American Insulating Mach'y Co., Phila, Pa.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Covering Wire
American Insulating Mach'y Co., Phila, Pa.
Royle, John & Sons, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cutting
Eisler Engineering Co., Newark, N. J.
Lewis Machine Co., The, Cleveland, Ohio.
Moslo Machinery Inc., Cleveland, Ohio.
National Mach'y Exch., (Used). New York, N.Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Porter, H. K. Inc., Everett, Mass.
Shuster, F. B. Mfg., Co., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Die Making
Carboloy Co., Inc., Detroit, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Roos, H. & G., Tool & Mfg. Co. Montclair, N.J.
Wayne Wire Die Co., Hillside, N. J.

MACHINERY—Draw Benches
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Edging
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Enameling
American Insulating Mach'y Co., Phila., Pa.
Industrial Ovens, Inc., Cleveland, O.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Extruding
Robertson John, Co., Brooklyn, N. Y.
Royle, John, & Sons, Paterson, N. J.

MACHINERY—Fence
Glader, Wm. Machine Works, Chicago, Ill.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Filament Coil Winding
Eisler Engineering Co., Newark, N. J.

MACHINERY—Flat Wire
Ruesch, H. J., Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Forming
Eisler Engineering Co., Newark, N. J.
National Mach'y Exch. (Used), New York, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.
Seifert, E. R., Inc., Syracuse, N. Y.
Sleeper & Hartley, Inc, Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Galvanizing
Wilson, Lee, Engr. Co., Cleveland, Ohio.

MACHINERY—Galvanizing Wire
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Wean Equipment Corp., Cleveland, Ohio.
Wilson, Lee, Engr. Co., Cleveland, Ohio.

MACHINERY—Gang Winders
Entwistle, Jas. L. Co., Pawtucket, R. I.
Ruesch, H. J., Machine Co., Newark, N. J.
Syncro Machine Co, Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Grinding
Norton Co., Worcester, Mass.

MACHINERY—Insulating
American Insulating Mach'y Co., Phila, Pa.
New England Butt Co., Providence, R. I.
Royle, John & Sons, Paterson, N. J.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lead Encasing Presses, etc.
Robertson, John Co., Brooklyn, N. Y.

MACHINERY—Lead Stripping
Robertson, John Co., Brooklyn, N. Y.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Magnet Wire
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Material Handling
Cleveland Tramrail, Div. of the Cleveland.
Crane & Engineering Co., Wickliffe, O.

MACHINERY—Measuring Wire & Cable
Durant Mfg. Co., Milwaukee, Wis.
Entwistle, Jas. L. Co., Pawtucket, R. I.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail and Tack
Glader, Wm. Machine Works, Chicago, Ill.
National Mach'y Exch. (Used), New York, N.Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Wean Equipment Corp., Cleveland, Ohio.

WHERE TO BUY, Continued

MACHINERY—Panning
American Insulating Mach'y Co., Phila., Pa.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Pointing
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Mach., Co., Trenton, N.J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Standard Mill Supply Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machinery Co., Waterbury, Conn.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Rod Mill
Morgan Construction Co., Worcester, Mass.
Ruesch, H. J., Machine Co., Newark, N. J.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Rolling Mill
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York, N.Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Waterbury-Farrel Foundry & Machinery Co., Waterbury, Conn.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Rubber for Insulating Wire
Royle, John & Sons, Paterson, N. J.

MACHINERY—Rubber Tubing and Straining
New England Butt Co., Providence, R. I.
Royle, John & Sons, Paterson, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Screw Wire
National Mach'y Exch. (Used), New York, N. Y.
Sleeper & Hartley, Inc, Worcester, Mass.

MACHINERY—Special
American Insulating Mach'y Co., Phila, Pa.
Emory, Robert J., Co., Newark, N. J.
Entwistle, Jas. L. Co., Pawtucket, R. I.
New England Butt Co., Providence, R. I.
Ruesch, H. J., Machine Co., Newark, N. J
Scudder, E. J., Fdry. & Mach., Co., Trenton, N.J.
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I. (Special Designs).
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Spooling
American Insulating Mach'y Co., Phila., Pa.
Eisler Engineering Co., Newark, N. J.
Emory, Robert J., Co., Newark, N. J.
Entwistle, Jas. L. Co., Pawtucket, R. I.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N .J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Foundry & Machinery Co., Waterbury, Conn.
Watson Machine Co., Paterson, N. J.
Wire & Textile Mach'y, Inc., Pawtucket, R. I.

MACHINERY—Spring Making
National Mach'y Exch. (Used), New York, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Staple
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Straightening
Lewis Machine Co., The, Cleveland, Ohio.
Moslo Machinery Co., Cleveland, Ohio.
National Mach'y Exch. (Used), New York, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Ruesch, H. J., Machine Co., Newark, N. J
Shuster, F. B., Mfg. Co., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Stranding
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Strip Steel
Ruesch, H. J., Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Swaging
National Mach'y Exch. (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J
Sleeper & Hartley, Inc., Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N .J.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.

MACHINERY—Taping
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N .J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Testing Equipment—Sparkers
Entwistle, Jas. L., Pawtucket, R. I.

MACHINERY—Testing Spring
Standard Machinery Co., Providence, R. I.

MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y Co., Phila., Pa.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Trolley Wire
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill
Ruesch, H. J., Machine Co., Newark, N. J.
Torrington Mfg. Co., Torrington, Conn.

MACHINERY—Welding Wire
Eisler Engineering Co., Newark, N. J.
Micro Products Co., Chicago, Ill.
Sciaky Bros., Inc., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Winding
American Insulating Mach'y Co., Phila., Pa.
Eisler Engineering Co., Newark, N. J.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wind-up (Constant Tension, Variable Speed)
Industrial Ovens, Inc., Cleveland, O.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Bending
Eisler Engineering Co., Newark, N. J.
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

MACHINERY—Wire Drawing
American Insulating Mach'y Co., Phila, Pa.
Eisler Engineering Co., Newark, N. J.
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch. (Used), New York, N. Y.
Ruesch, H. J., Machine Co., Newark, N. J.
Scudder, E. J., Fdry. & Mach., Co., Trenton, N.J.
Sleeper & Hartley, Inc, Worcester, Mass.
Standard Machinery Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Waterbury-Farrel Fdry. & Mach. Co., Waterbury, Conn.
Wean Equipment Corp., Cleveland, Ohio.

MACHINERY—Wire Rope
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J .

MACHINERY—Wire Tinning
American Insulating Mach'y Co., Phila, Pa.
New England Butt Co., Providence, R. I.
Syncro Machine Co., Perth Amboy, N. J.

MACHINERY—Wood Screw
National Mach'y Exch. (Used), New York, N. Y.

MATERIAL HANDLING EQUIPMENT
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

MILLS—Tandem Rolling and Edging
Standard Machinery Co., Providence, R. I.
Torrington Mfg. Co., Torrington, Conn.

NAILS—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.

NICKEL SILVER AND PHOSPHOR BRONZE—Rod, Wire and Strip
Hudson Wire Co., Ossining, N. Y.

OILS—Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Miller, R. H., Co., Inc., Homer, N. Y.
Oakite Products, Inc., New York, N. Y.
Shell Oil Co., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

OVENS—Cable Lacquering
American Insulating Mach'y Co., Phila., Pa.
Industrial Ovens, Inc., Cleveland, Ohio.

OVENS—Dehydrogenizing
Carl-Mayer Corp., The, Cleveland, Ohio.
Industrial Ovens, Inc., Cleveland, Ohio.

OVENS—Industrial
Carl-Mayer Corp., The, Cleveland, Ohio.
Industrial Ovens, Inc., Cleveland, Ohio.
Ross, J. O., Engr. Corp., New York, N. Y.

OVENS—Welding Rod Coating
Carl-Mayer Corp., The, Cleveland, Ohio.
Industrial Ovens, Inc., Cleveland, Ohio.
Moslo Machinery Co., Cleveland, Ohio.
Ross, J. O., Engr. Corp., New York, N. Y.

PAINTS—Heat Resisting
American Chemical Paint Co., Ambler, Pa.

PAINTS—Marine
American Chemical Paint Co., Ambler, Pa.

PAINTS—Structural Steel
American Chemical Paint Co., Ambler, Pa.

PANS—Lead and Spelter
National Annealing Box Co., Washington, Penna.

PANS—Vulcanizing
Mossberg Pressed Steel Corp., Attleboro, Mass.

PAPER—Creped Wrapping
Crepe-Kraft Co., Newark, N. J.

PAPER—For Coil Wrapping and Corrosion Prevention
Crepe-Kraft Co., Newark, N. J.

PAPER TESTERS—
Scott Testers, Inc., Providence, R. I.

PATENT ATTORNEYS—
Lancaster, Allwine and Rommel, Washington, D.C.

PICKLING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Phila., Pa.
Oakite Products, Inc., New York, N. Y.
Parkin, Wm. M., Co., Pittsburgh, Pa.

PICKLING TANK LININGS—
Ceilcote Co., The, Cleveland, Ohio.
Haveg Corp., Newark, Del.
Heil Process Equipment Corp., Cleveland, Ohio.
Sauereisen Cements Co., Pittsburgh, Pa.

PIPES & FITTINGS—Acid Resistant
Ceilcote, Co., The, Cleveland, Ohio.
Haveg Corp., Newark, Del.
Heil Process Equipment Corp., Cleveland, Ohio.

PLASTIC TESTERS—
Scott Testers, Inc., Providence, R. I.

POTS—Lacquer
Industrial Ovens, Inc., Cleveland, Ohio.

POTS—Lead Melting
National Annealing Box Co, Washington, Pa.
Robertson, John, Co., Brooklyn, N. Y.

POWDER—Wire Drawing
Apex Alkali Products Co,. Phila, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H., Co., Inc., Homer, N. Y
Potter, Neil C., Newark, N. J.
Standard Industrial Compounds Co., Chicago, Ill.

PRESSES—Hydraulic and Mechanical
Robertson, John, Co., Brooklyn, N. Y.
Standard Machinery Co., Providence, R. I. (Mechanical Only)

PRESSES—Lead
Robertson, John, Co., Brooklyn, N. Y.

PRESSURE VESSELS—
National Annealing Box Co., Washington, Penna.

PULLERS—Wire
Scudder, E. J., Fdry. & Mach., Co., Trenton, N.J.
Sleeper & Hartley, Inc, Worcester, Mass.

PUMPS—Hydraulic
Robertson, John, Co., Brooklyn, N. Y.

REEL AND TENSION STAND—
Industrial Ovens, Inc., Cleveland, Ohio.
Moslo Machinery Co., Cleveland, Ohio.
Sleeper & Hartley, Inc, Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

REEL CRUTCHES—
Watson Machine Co., Paterson, N. J.

WHERE TO BUY, Continued

REELS—Annealing and Stranding
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Company, Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

REELS—Collapsible
Entwistle, Jas. L. Co., Pawtucket, R. I.

REELS—Steel
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

REELS AND SPOOLS—Shipping and Shop
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

REELS—Takeoff
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Company, Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Shuster, F. B., Mfg. Co., New Haven, Conn.
Stevens Metal Products Co., Niles, Ohio.

REELS—Vulcanizing & Impregnating
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

REELS—Wire Drawing
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Company, Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

REFRACTORIES—High Temperature
Norton Company, Worcester, Mass.

ROD BAKERS—
Carl-Mayer Corp., The, Cleveland, Ohio.
Moslo Machinery Co., Cleveland, Ohio.
Ross, J. O., Engineering Corp., New York, N.Y.

RODS—Nickel Alloy
International Nickel Co., Inc., New York, N. Y.

RODS—Stainless Steel
Rustless Iron & Steel Div., American Rolling Mill Co., Baltimore, Md.

RODS—Wire—Non-Ferrous
Hudson Wire Co., Ossining, N. Y.
Platt Bros. & Co., The, Waterbury, Conn.

RODS—Wire—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Roebling's John A., Sons Co., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

ROLL STRAIGHTENERS—
Moslo Machinery Co., Cleveland, Ohio.

ROPE—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.

RUBBER AND RUBBER COMPRESSION TESTERS—
Scott Testers, Inc., Providence, R. I.

RUST PROOF COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Oakite Products, Inc., New York, N. Y.

RUST REMOVING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.
Apex Alkali Products Co., Philadelphia, Pa.
Heil Process Equipment Corp., Cleveland, Ohio.
Standard Industrial Compounds Co., Chicago, Ill.

SATURATION SYSTEMS
Industrial Ovens, Inc., Cleveland, Ohio.
Watson Machine Co., Paterson, N. J.

SHEARS—
O'Neil-Irwin Mfg. Co., Minneapolis, Minn.

SHEET—Steel
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Youngstown Sheet & Tube Co., Youngstown, O.

SOAPS—Industrial and Wire Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Bick, Hans C., Inc., Reading, Pa.
Magnus Chemical Co., Garwood, N. J.
Miller, R. H. Co., Inc., Homer, N. Y.
Potter, Neil C., Newark, N. J.
Shell Oil Co., Inc., New York, N. Y.
Standard Industrial Compounds Co., Chicago, Ill.

SOLVENT RESIN SYSTEMS—Experimental
Industrial Ovens, Inc., Cleveland, Ohio.

SPOOLS—Annealing and Wire Drawing
Apco Mossberg Co., Attleboro, Mass.
Howsam Spool Company, Aurora, Ill.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

SPOOLS—Shipping and Shop
Apco Mossberg Co., Attleboro, Mass.
Howsam Spool Company, Aurora, Ill.
Hubbard Spool Company,. Chicago, Ill
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

SPOOLS—Steel
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Stevens Metal Products Co., Niles, Ohio.

SPRINGS—Tools for Forming
State Machine Tool Co., Hartford, Conn.

STAMPINGS—Steel
Hubbard Spool Company, Chicago, Ill.
Mossberg Pressed Steel Corp., Attleboro, Mass.

STRIP—Brass and Non-Ferrous
Hudson Wire Co., Ossining, N. Y.

STRIP—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa
Roebling's, John A., Sons Co., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

SWIFTS—Take-off
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
Watson Machine Co., Paterson, N. J.

TANK LININGS—Brick
Ceilcote Co., The, Cleveland, Ohio.
Keagler Brick Co., Steubenville, Ohio.

TANK—Compound
Haveg Corp., Newark, Del.
Watson Machine Co., Paterson, N. J.

TANKS—Pickling
Ceilcote Co., The, Cleveland, Ohio.
Haveg Corp., Newark, Del.
Heil Process Equipment Corp., Cleveland, Ohio.

TANKS—Steel
Mossberg Pressed Steel Corp., Attleboro, Mass.
National Annealing Box Co., Washington, Penna.

TOOLS—Spring Forming
State Machine Tool Co., Hartford, Conn.

TOOLS—Wire Cutting
Porter H. K., Inc., Everett, Mass.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, O.

TRAVERSES—For Reels
Entwistle, James L. Co., Pawtucket, R. I.
Hubbard Spool Company, Chicago, Ill.
Stevens Metal Products Co., Niles, Ohio.

TRAVERSE MECHANISMS—
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Attleboro, Mass.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

TREADS—Safety
Norton Co, Worcester, Mass.

TUBE BENDERS AND FORMERS—
Ruesch, H. J. Machine Co., Newark, N. J.

TURKS HEADS—Friction and Power
Standard Machinery Co., Providence, R. I.

VALVES AND FITTINGS—Acid Resistant
Haveg Corp., Newark, Del.

VARNISHES—For Insulation
Standard Varnish Wks., Staten Island, N. Y.

VULCANIZERS—
Watson Machine Co., Paterson, N. J.

VULCANIZING PANS—
American Insulating Mach'y Co., Phila., Pa.
Mossberg Pressed Steel Corp., Attleboro, Mass.

WELDERS—Spot and Butt
Eisler Engineering Co., Newark, N. J.
Micro Products Co., Chicago, Ill.
Moslo Machinery Co., Cleveland, Ohio.

WIND-UP AND UNWIND SYSTEMS—Continuous
American Insulating Mach'y Co., Phila, Pa.
Entwistle, James L. Co., Pawtucket, R. I.
Industrial Ovens, Inc., Cleveland, O.
Watson Machine Co., Paterson, N. J.

WIRE—Aluminum
Aluminum Co. of America, Pittsburgh, Pa.
Malin & Co., Cleveland, Ohio.

WIRE—Cast
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Cold Heading
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Roebling's John A., Sons Co., Trenton, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Electric
Hudson Wire Co., Ossining, N. Y.
Malin & Co., Cleveland, Ohio.

WIRE—Enameled for Coils
North American Philips Corp., Dobbs Ferry, N.Y.
Winsted Div. of Hudson Wire Co., Winsted, Conn.

WIRE—Manufacturers
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth Sterling Steel Co., McKeesport, Pa.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Reynolds Wire Co., Dixon, Ill.
Roebling's, John A., Sons Co., Trenton, N. J.
Rustless Iron & Steel Div., American Rolling Mill Co., Baltimore, Md.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Music
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Malin & Co., Cleveland, Ohio.

WIRE—Nickel & Nickel Alloy
International Nickel Co., Inc., New York, N.Y.

WIRE—Nickel Silver and Phosphor Bronze
Hudson Wire Co., Ossining, N. Y.
Malin & Co., Cleveland, Ohio.

WIRE—Non-Ferrous to Specification for Special Purposes
Hudson Wire Co., Ossining, N. Y.
North American Philips Co., Inc., Dobbs Ferry, N. Y.
Winsted Div. of Hudson Wire Co., Winsted Conn.

WIRE—Spring
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Indiana.
Firth-Sterling Steel Co., McKeesport, Pa.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Rustless Iron & Steel Div., American Rolling Mill Co., Baltimore, Md.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Stainless Steel
Firth-Sterling Steel Co., McKeesport, Pa.
Rustless Iron & Steel Div., American Rolling Mill Co., Baltimore, Md.

WIRE—Steel—Also Coppered Steel—Also Galvanized Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Firth-Sterling Steel Co., McKeesport, Pa.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE—Zinc
Platt Bros. & Co., The, Waterbury, Conn.

WIRE CLOTH—Industrial
Roebling's John A., Sons Co., Trenton, N. J.
Reynolds Wire Co., Dixon, Ill.

WIRE TESTERS—
Scott Testers, Inc., Providence, R. I.

WIRE, WEAVING—Non-Ferrous
Hudson Wire Co., Ossining, N. Y.
Reynolds Wire Co., Dixon, Ill.

WIRE WINDER
Standard Mill Supply Co., Providence, R. I.

WRAPPING PAPER—Creped
Crepe-Kraft Co., Newark, N. J.

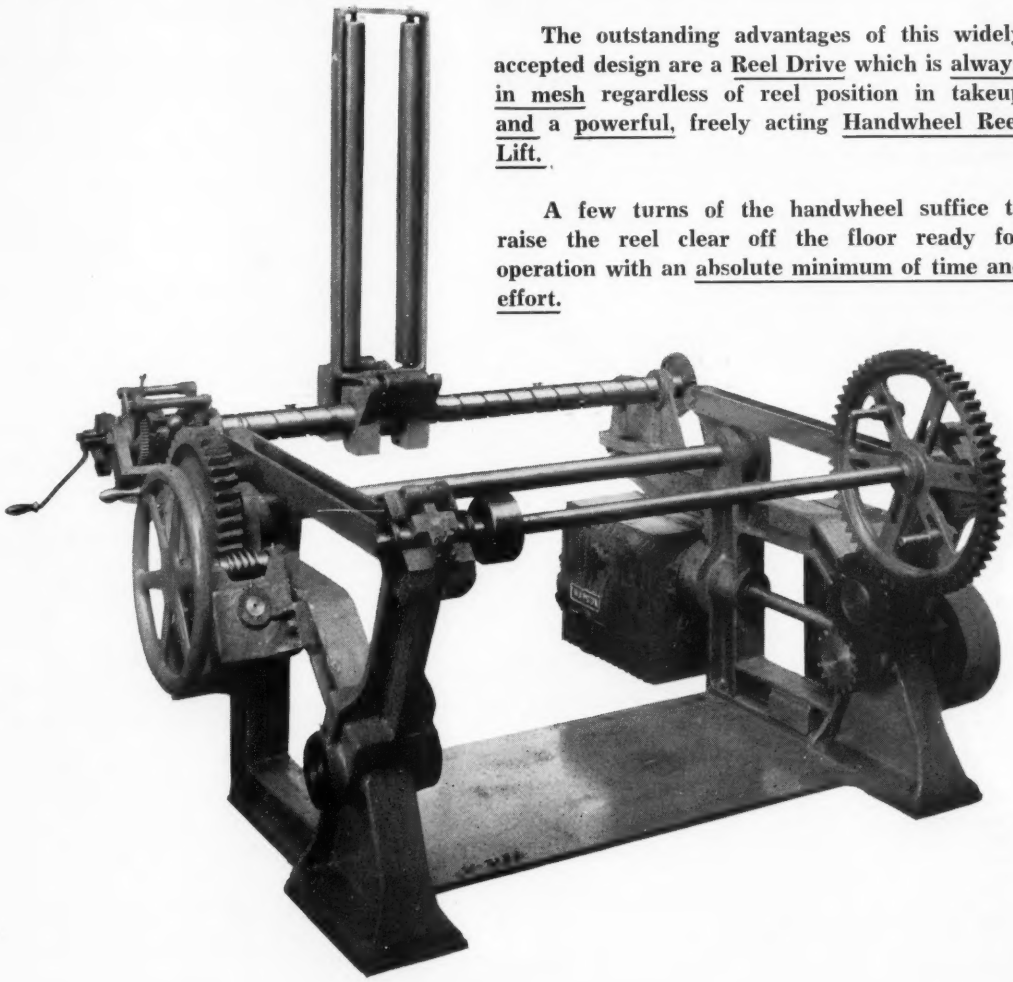
YARN TESTERS—
Scott Testers, Inc., Providence, R. I.

The WATSON MACHINE COMPANY
ESTABLISHED 1845
PATERSON 3, NEW JERSEY, U. S. A.

Wire & Wire Products
November 1946

ELECTRICAL WIRE AND CABLE AND WIRE ROPE MACHINERY

Mechanical-Lift TAKEUPS Type "W"



The outstanding advantages of this widely accepted design are a Reel Drive which is always in mesh regardless of reel position in takeup and a powerful, freely acting Handwheel Reel Lift.

A few turns of the handwheel suffice to raise the reel clear off the floor ready for operation with an absolute minimum of time and effort.

Takeup Size W —	30″	42″	48″	60″	72″	84″
Max. Reel Load — in Tons	1	2	2	4	6	6
Min. Reel Pickup (From Floor)	14″	24″	30″	36″	36″	36″

Above cut W-3126 illustrates a 60″ Size, Type "W" Takeup with a D/40 Transmission and an automatic "RR" Traverse which are commonly provided on Strander Takeups.

Frames are machined to mount any of our standard Traverses. Various other controls, such as "Push-Button", "Foot-Station", "Foot-Treadle", "Hydraulic-Float-Roll" etc. are also available.

EF

GAS FIRED, OIL FIRED AND ELECTRIC FURNACES ARE BUILT IN THESE MANY TYPES

- Bell or Hood Types
- Box or Hearth
- Car Type
- Catenary
- Chain Belt Conveyor
- Chain Strand Conveyor
- Combination Gas—Electric
- Convection Heating
- Elevator Type
- End Heating
- Flame Heating
- Low Frequency Induction
- Mesh Belt Conveyor
- Pit Types
- Pusher Types
- Reciprocating Hearth
- Roll Down
- Roller Hearth
- Roller Rail
- Rotary Hearth
- Recuperative
- Revolving Retort
- Salt Bath—Continuous
- Screw Conveyor
- Shaker Hearth
- Slat Conveyor
- Special Atmosphere
- Suspended Conveyor
- Tube Types
- Walking Beam

Complete with Special Charging and Discharging, Special Quenching and Washing, Special Atmosphere, and Special Handling Equipment to Meet Your Particular and Individual Requirements.

LOOK US UP AT BOOTH D-169 A.S.M. SHOW ATLANTIC CITY NOV. 18th TO 22nd

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FOR THESE MANY SERVICES

- Ageing
- Aluminum Brazing
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- Billet Heating
- Brass Brazing
- Bright Annealing
- Carbon Restoration
- Carburizing
- Ceramic Decorating
- Clean Annealing
- Copper Brazing
- Drawing
- Enameling
- Forging
- Glass Fusing
- Glass Heat Treating
- Hardening
- Homogenizing
- Malleablizing
- Nitriding
- Normalizing
- Patenting
- Process Heating
- Scale-Free Hardening
- Silver Soldering
- Sintering
- Solution Heat Treating
- Special Atmosphere Treatments
- Spheroidizing
- Stress Relieving

Let EF Engineers, with Their Long and Successful Experience, Work with You On Your Next Job!

THE ELECTRIC FURNACE CO.

GAS FIRED, OIL FIRED AND ELECTRIC FURNACES FOR ANY PROCESS, PRODUCT OR PRODUCTION

Salem-Ohio